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VOL. XL. 1 DECEMBER, 1933. PART 6.

Event and Comment.

Boys for the Land.—Speech by the Premier.

"AGRICULTURE is the first essential in any civilisation; it is man's natural occupation. We must use the gifts of our land to the best advantage, and what better settlers could we have than the natives of the country, who know its conditions and do not require to become acclimatised? Every effort the Government can make to assist the development of landmindedness among the boys of our State will be made."

Those remarks of the Premier (Hon. W. Forgan Smith) in the course of a recent speech in the Legislative Assembly found a ready echo on both sides of the House. Dealing generally with the boy employment problem and its relationship to land settlement, the Premier said:—

> Immigration, as every hon. member knows, practically ceased in 1930. The Commonwealth Government, who control this matter, intimated to the British Government that they had suspended the Migration Agreement that had hitherto been in operation. There is no assisted immigration in Queensland or Australia at the present time, with the exception of nominated passengers. The Commonwealth Government agreed to accept the nomination system under restricted conditions; that is to say, if a man is settled here and in employment he is at liberty to nominate his wife and family or his relatives in his country of origin. Obviously, that is a sensible arrangement, but strict inquiries are made as to his capacity to maintain them on their arrival here so that they shall not be a charge on the State or the Commonwealth. Very few nominations take place. I could not say off-hand how many have passed through the Chief

Secretary's Office from 1930 up to date, but the State Government, through their officers stationed in various districts, act as agents for the Commonwealth. When a person is nominated the fee has to be lodged with the clerk of petty sessions or the officer in Brisbane, and is then sent on with a full report of the standing of the person concerned. The Commonwealth officers then decide whether the passage shall be granted.

No new boys are coming out now, but under the terms of the agreement the after-care of the boys who have already migrated here is being continued. I consider that to be a sound and proper course to follow. There are boys who have come to Queensland under the original Migration Agreement, which stipulated that the State should provide an organisation to see that the boys were properly treated on their arrival here and were not exploited by employers, and that, generally speaking, they got that fair deal which would enable them to become absorbed in the population here, develop Australian sentiment and characteristics, and become useful units in our citizenship. So far as that phase of the matter is concerned, undoubtedly such immigration is a distinct success. We have no difficulty in Queensland with these boys at all. Employers are eager to obtain their services, and the wages and conditions are fair in all the circumstances. There are many instances of which I know myself, and others which have been reported to me. Migration officers and the New Settlers' League have found that those boys have become successful settlers. The suggestion has been made that in any large opening of Crown lands the boys who have been successfully settled in the country for a given period and have had experience should have some special area set apart for them so that they can take up land if they wish. No decision has been arrived at on that matter, but they have equal opportunities with others. Generally speaking, this scheme of immigration has been a success, and these boys have been absorbed in the population, and are likely to become successful citizens. In every body of men there is a certain percentage of wasters. One cannot expect to have 100 per cent. perfection in this any more than in any other matter. The boys are being properly cared for.

Boys wanted for Farm Work.

CONTINUING, the Premier discussed the general question of placing boys on the land, and remarked:—

There is without doubt a demand for boys for farm work at the present time, but that demand is not being met. I have received reports from the New Settlers' League about applications that cannot be entertained because the boys are not available. To me the position is tragic. I view very seriously indeed the fact that the people of this country are not prepared to settle on the land of this country. (Honourable Members: Hear, hear!) That is really a most unfortunate thing; it is probably the most serious social question of the present time. Let us be quite plain and blunt about it. We refer to the tenure of land as being based on the principle of its use, so that it may supply the country with what it needs. If our own native population are not prepared to settle on the land and use the land, then difficulties of a very grave character may arise in the future. The Government, through the Department of Public Instruction and the Department of Agriculture, are doing everything possible to advise senior pupils in the State schools about the opportunities that are available in that direction; but it is not so much that the boys need to be encouraged to contemplate a career on the land—it is a question of converting the parents themselves. I regard it as a pitiful thing that a parent would prefer to have his boy in the city on the dole rather than that he should go on the land and become capable of earning a livelihood. Nothing is worse from the point of view of the morale of the people than that boys should grow up with

the idea that the State must keep them. That is my blunt view about the position. It is the duty of the State to give to all our citizens an opportunity to earn their livelihood, but it is the duty of the individual to earn that livelihood where it is available. (Honourable Members: Hear, hear!) That is a sound principle that I contend cannot be combated, and everyone knows that the most critical period in a boy's life is between the time he leaves school and, say, twenty-one years of age. During that period boys develop those characteristics which determine their future lives. It is then that habits are formed, and good habits can be formed just as well as bad habits. There is no better habit than the habit of work. Work properly done and properly applied is not a curse, it is God's greatest blessing. Life on the land is a variety of work that can be made a habit. The policy of the Labour Government and the policy of every sane thinker has always been to give the men on the land that reasonable chance of earning a decent livelihood which is the birthright of everyone in this country. We must use the gifts of our land to the best advantage; and what better settlers could we have than the natives of the country who know its condition and who do not require to be acclimatised? Every effort the Government can make to assist the development of land-mindedness among the boys of our State will be made. It is however, a matter which the parents should seriously take up with themselves in the light of the future welfare of their families and the future welfare of the country. A quaint idea is current amongst some people that life on the land is a menial occupation. Yet it is the natural occupation of man to till the soil and produce the things that are necessary for the maintenance and comfort of human life. Agriculture is the first essential in any form of civilisation; it is man's natural occupation. Therefore there can be nothing menial about it; it is honourable in the highest degree. It is true that the man on the land has to face considerable difficulties; but does that not also apply to every other kind of human endeavour? The farmer is beset with difficulties caused by droughts, natural pests, and low price levels, but what of the man in the city? Is not the man who follows a clerical occupation subject to the risk of unemployment and its consequent destitution? The artisan—the carpenter or the engineer—spends years of his life in learning his trade. Is it not likely that he will suffer from unemployment? Are not the difficulties of such workers analogous in the ultimate to the difficulties that beset the man on the land? I definitely assert that the efficient agriculturist on good land enjoys better conditions of living than the artisan in the city, who is subject to the fluctuating conditions of unemployment and its consequent difficulties. A very interesting story is recalled to my mind in this connection. I remember not very long ago discussing with a boy his prospects in life. He intimated very definitely to me that it was his desire to go on the land, to cultivate the land, and to become a producer. I questioned him to ascertain definitely whether it was a mere passing whim or whether his desire was deeply rooted. Finally he told me: 'If I can get on to my own farm, cultivating my own land, nobody can give me the D.C.M.' I said: 'That is a new one on me—the D.C.M. What do you mean by the D.C.M.?' He said, 'Don't come Monday.' He went on to say that if he were working in the city his employer at any time could say, 'Don't come Monday,' but if he were engaged upon his own farm no one could remove him from his land, and he would be free to work out his own destiny. That is the kind of spirit that we desire to cultivate amongst our boys, and that is the spirit that will lead to success in any form of human endeavour. I welcome suggestions from any hon. member or from any public-spirited institution that are calculated to remedy the difficulties with a view to settling our own boys on the land, thereby building up a healthy rural population of our own kith and kin.

A New Disease of Cane in North Queensland.

By ARTHUR F. BELL.

DURING the progress of a disease survey of North Queensland early in 1929, shortly after the formation of the Division of Pathology, we began to form the opinion that in addition to leaf-scald there was present a similar, but distinct disease. On various occasions we found leaf symptoms similar to those of leaf-scald disease, but could find none of the confirmatory symptoms usually associated with leaf-scald. Owing to the very wide distribution of leaf-scald throughout North Queensland one could never be certain that it was not present in any particular instance, and consequently there was always the possibility that these particular leaf markings were but variations of the symptoms of leaf-scald. Laboratory tests failed to confirm this possibility, and although the isolation and culture of the causal bacteria of leaf-scald is a simple matter, in this case no such causal organism could be demonstrated. This possibly new disease was accordingly provisionally termed "pseudo-scald," and its presence recorded in the Annual Report for 1929.

In the meantime, it was learned that an apparently similar disease had attracted attention in Java about the same time, and in 1930 a short account of a new disease was published by the Pathologist of the Hawaiian Sugar Planters' Association. A study of this account left little doubt that the diseases of Hawaii and Queensland were identical; however, during the International Conference of Sugar Cane Technologists in March, 1932, the Pathologists of Java, Hawaii, and Queensland met in Porto Rico, and there found a disease which each identified as being exactly similar to the new disease of his particular country. Furthermore, in Porto Rico, unlike these other three countries, the situation was not complicated by the presence of true leaf-scald and so the symptoms could be recorded with certainty. There can now be no doubt that these four countries, at least, have this disease in common, and that it is quite distinct from leaf-scald. In Java it has been known as "fourth disease," while in Hawaii it was termed "chlorotic streak" disease.

Last spring, with the assistance of Mr. H. G. Knust, of the Tully Cane Pests Board, we were able to obtain a small supply of Badila which was infected with this pseudo scald, or chlorotic streak disease, and which we were quite sure (knowing the complete history of the field) had not leaf-scald disease. Cuttings were brought to Brisbane and planted in the Pathology Plot, one-half of the cuttings being planted without treatment while the other half were given warm water treatment before planting. The cane was planted on 30th August, 1932, and the treated cuttings germinated about one week ahead of the untreated. In spite of frequent watering the very young untreated cane wilted badly in the middle of the day while the treated cane remained turgid and continued to grow at a greater rate than the untreated. When the cane was three months old the characteristic leaf streaks (see page 462 and Plate 125) began to appear in odd leaves of the untreated stools;

they remained visible until the cane was seven to eight months old but could not be found at any later date. Fourteen of the sixteen untreated stools bore these leaf symptoms, while not a single streak was ever observed in the stools arising from the treated cuttings. It is evident then that in this particular experiment, as was found in Hawaii, warm water treatment for twenty minutes at 52 deg. Centigrade had enabled the plants to throw off the disease.

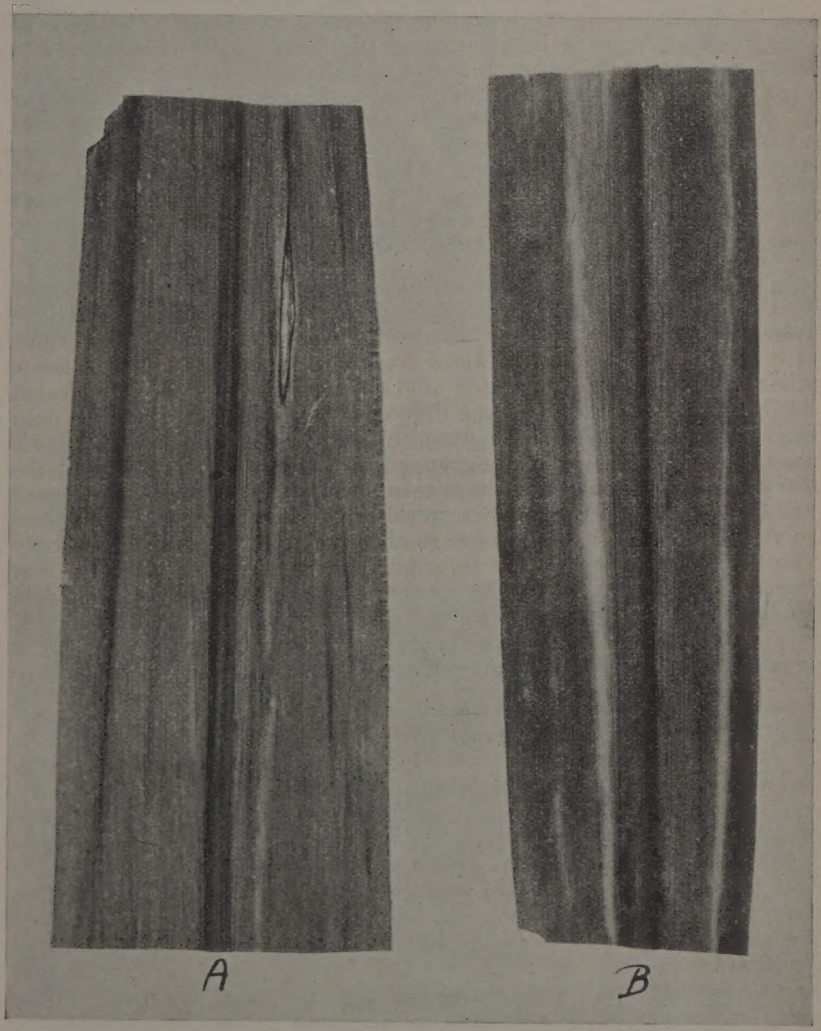

Plate 125.

Typical leaf streaks. In B are shown the more usual narrow type of streak and one of the broader, more diffuse type. Note wavy outline, variable width, and fragmented nature of streaks. In A is shown portion of an older streak in which the tissue has commenced to die; the ashy coloured centre and reddish border of this zone are well illustrated.

Throughout their whole life the stools from the warm water treated cuttings maintained a much more rapid rate of growth than the untreated stools, and when harvested at twelve months old the former greatly outyielded the latter. The difference in yield will be appreciated on reference to the two photographs reproduced in Plates 126 and 127. In Plate 126 we have a photograph taken at the junction of the two lots of cane, that from the treated cuttings growing to the left of the plot peg, while the stunted stools from the untreated cane lie to the right. A very marked difference in the height of the cane, which could scarcely be due to soil differences, is apparent in the immediately adjacent stools. Parallel with the difference in height of the stools was a marked difference in the stooling habit, the untreated cane averaging three stalks per stool while the treated averaged five stalks per stool. The first twelve stools on either side of the peg were then harvested and placed in two heaps, and again the difference in yield is brought out by the second photograph (Plate 127); the larger heap on the left is composed of cane cut from twelve stools of treated cane while that on the right is the cane from a similar number of stools from untreated cuttings.

Undoubtedly quite a startling difference in yield has been obtained by the planting of the diseased cuttings in contrast to diseased cuttings rendered apparently healthy by warm water treatment. Of course it is well known that warm water treatment of normal cuttings has a stimulating effect on germination (and so on growth), so that if untreated healthy cane had been used the difference obtained may not have been so great. Furthermore, this experiment was carried out in the temperate zone, where Badila is usually cropped as a two-year old cane, and the difference in yield might not have been nearly so great if the experiment had been conducted in the wet tropical belt. Nevertheless the difference in yield is so great as to demand further investigation, and accordingly two field trials have already been planted, one in the Tully area and one in the Mulgrave area. In the former warm water treated diseased Badila is being grown in plots side by side with the untreated cane, while in the latter, diseased and healthy (Tableland Nursery Badila, not treated) cane are being compared.

The symptoms of the disease are easy to describe; the chief difficulty often is to find them in the diseased plant. The leaf symptoms as found in Badila are illustrated in Plate 125. They consist of long, narrow, cream to white, longitudinal streaks in the blade of the leaf, ranging in width from 1-16 to 3-16 inch and rarely being of uniform width throughout their length (see Plate 125B). They run in the direction of the veins of the leaf and may extend the whole length of the leaf but more frequently are less than 1 ft. in length, and are often fragmented. In older streaks the leaf tissue within the boundaries of the streaks frequently dies and assumes an ashy-grey colour surrounded by a narrow reddish border (Plate 125A); these dead areas are at first small but may later extend almost the whole length of the streak. They may be distinguished from the typical young streaks of leaf-scald by the wavy outline and varying width, as compared with the sharply defined uniform streaks of leaf-scald. In the later stages leaf-scald streaks become broad and diffuse, with broad dead areas extending in from the margins, but this is not the case with the disease in question. The streaks do not pass from the leaf blade down on to the leaf sheath as in leaf-scald, while the latter streaks are rarely, if ever, fragmented.

PLATE 126.

Striking effect of warm water treatment of cuttings of Badila cane affected with this disease. The larger stools on the left of the white plot peg grew from treated cuttings and remained apparently healthy throughout the life of the crop, while the stunted stools to the right of the peg were obtained from untreated cuttings and bore numerous typical leaf streaks. Cane growing in Pathology Plot, Brisbane.

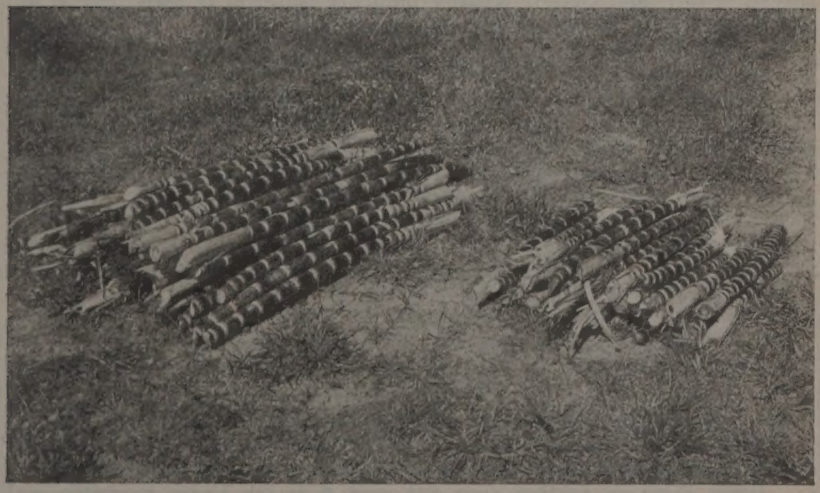

PLATE 127.

The cane harvested from 12 stools grown from treated cuttings (left) and 12 stools grown from untreated cuttings (right). See also Plate 126.

Upon cutting open diseased stalks a few reddened fibres may be found but they are not numerous. None of the confirmatory symptoms of leaf-scald, such as side shooting, almost complete loss of green leaf colour, or death of mature cane, can be found.

The leaf symptoms as here described and illustrated are best found in Badila when the young crops are just commencing to make cane—about October-November. As the cane grows higher they frequently disappear, and by the following March it may be impossible to find a single leaf-streak in a field which is known to be approximately 100 per cent. diseased. The streaks are most apparent on the older leaves but they are often not at all numerous, in fact quite frequently only a single leaf streak can be found in the whole stool.

The origin of this disease is not known, but its wide-spread distribution proves that it has been in the country for many years. It has been found in places throughout the area north of Cardwell but a shortage of Field Staff has prevented a farm to farm survey to determine the percentage of farms affected. Its presence has been reported, but not confirmed, on a few farms in the Mackay district, and has definitely been recorded in a field of Badila ratoons on the Maroochy River. In the far north, Badila is, of course, the variety chiefly affected, but the disease has also been recorded in P.O.J. 2722, P.O.J. 2875, P.O.J. 2878, and S.C. 12/4. In Hawaii it has been observed on the following varieties:—P.O.J. 36, P.O.J. 213, P.O.J. 234, P.O.J. 979, P.O.J. 2714, P.O.J. 2727, P.O.J. 2878, E.K. 28, H. 109, Co. 213, Yellow Caledonia (Malabar), D. 1135, Badila, and a number of the newer Hawaiian seedlings.

The means by which this disease is spread from diseased to healthy plants is not yet known and is the subject of investigation both here and in Hawaii. Observations made so far indicate that the rate of spread is slow and that if healthy planting material is used that is all that is necessary to control the disease in most cases. In the meantime it is suggested that North Queensland farmers, particularly, be on the lookout for the disease during the next two or three months, and note its presence or absence in their fields. Should the two field trials at Tully and Mulgrave confirm the indications obtained in the small Pathology Plot trial, they will then be in a position to decide whether they are in need of fresh supplies of planting material, and make plans accordingly.

Additional Recommendations for the Control of Blue Mould of Tobacco.

By L. F. MANDELSON, B.Sc. Agr., Assistant Plant Pathologist.

THE control of blue mould is fully discussed in the Departmental leaflet "Tobacco Diseases," wherein the following points are stressed:—

(1) Field sanitation, which involves the prompt destruction of tobacco plants after the leaf has been harvested, and of plant refuse, and the eradication of volunteer plants.

(2) A suitable seed-bed site, which is well drained and not in a low-lying situation.

(3) Seed-bed soil, which is sufficiently fertile to ensure rapid and vigorous growth, and which has been sterilised prior to sowing.

(4) The use of seed from plants which have not been affected with blue mould.

(5) The beds should not be sown too thickly, and should later be thinned out to avoid overcrowding and to facilitate efficient spraying.

(6) The seedlings should be "hardened off"—i.e., given sufficient air and sunlight to encourage strong and vigorous growth.

(7) Visitors should not be permitted to inspect the seed-beds.

(8) Should blue mould be observed, the affected plants and those in their vicinity should be promptly eradicated by a heavy application of a formalin solution consisting of 1 part formalin to 25 parts of water. The treated area should later be dug out and the affected plants burnt.

(9) The seedlings should be sprayed with a suitable fungicide as soon as they are above ground.

Spraying Seed-beds for Blue Mould Control.

As a result of the experiments which are described elsewhere in this issue of the "Agricultural Journal," it is now possible to give fuller information on the subject of suitable fungicides.

For satisfactory results seedlings should be sprayed every four days. Additional applications are advisable when the plants are growing rapidly and after heavy storms. If beds are to be weeded or thinned out, it should be arranged for these operations to be carried out the same day that sprayings are made. It is best to spray seedlings late in the afternoon so that they will not be exposed to the heat of the sun when wet with spray, or else to protect them with hessian until the leaves are dry.

The method of application is most important, since it is essential that the lower as well as the upper surfaces of the leaves be thoroughly covered. Hence the spray should be applied with considerable pressure. A fine mist should be used when the seedlings are very small. Later a

PLATE 128.
Upper Fig.—Incorrect method of spraying tobacco seedlings.
Lower Fig.—Correct method of spraying tobacco seedlings.

flat spray should be applied, first from one side of the bed and then from the other, the spray rod being held at an acute angle to the ground so that the leaves are turned back by the force of the spray. Plate 128 illustrates the manner in which the spray should be applied. In Departmental spraying experiments a "Rega" IA bucket-pump with a combination Bordeaux-cyclone nozzle was found convenient for spraying tobacco seed-beds.

The results of the fungicide experiments may seem at first somewhat conflicting, but when all aspects are taken into consideration it would appear that two fungicides are outstanding and are worthy of recommendation. These preparations are home-made colloidal copper with soft soap as a spreader, and copper emulsion.

The former, probably due to the fineness of its particles and its excellent spreading quality, has considerable fungicidal value. The method for its preparation was only recently described, and consequently it has not been possible to investigate its value as a fungicide for tobacco seedlings very extensively. It has nevertheless given consistently satisfactory results. From the practical viewpoint it has two outstanding advantages over most fungicides—namely, that it is remarkably convenient to use and may be prepared very cheaply. The stock solution is made up simply, and will not rapidly deteriorate. For spraying purposes it is only necessary to dilute it with water and add the required amount of soft soap as a spreader.

Copper emulsion also is in a very fine state of division, and has excellent wetting properties. Unlike Bordeaux mixture it will stay in suspension for a considerable time. It has been more extensively tested than any other fungicide in recent experiments, and has been found satisfactory. Furthermore, it has been used rather extensively on a commercial scale for two seasons with considerable success. Unfortunately, however, it has certain disadvantages for general use. In the first place it can only be made with "soft" water, since "hard" water will react with the soap with disastrous results. It has been found that continual applications of the spray tend to cake the surface of the soil. Furthermore, to successfully prepare this fungicide considerable care is necessary in the accurate weighing-out and mixing of the ingredients. Nevertheless it can be recommended with confidence as an effective fungicide to growers who are prepared to take the necessary care in its preparation.

These two fungicides may be prepared in the manner described in the following paragraphs.

Home-made Colloidal Copper.

A stock solution of this fungicide is first prepared, and is diluted with water for spraying purposes. A grower may consequently make up sufficient concentrated fungicide for two or three months' spraying operations at one time.

Details for the preparation of the stock solution are as follows:—

One pound of bluestone "fines" is first dissolved in two quarts of water. The "fines" are preferable to crystals, since they dissolve more readily. The bluestone is best dissolved by suspending in a bag in water which may be heated to accelerate the process. It should be

dissolved in a wooden tub or some non-metallic vessel, since this chemical will react with metals. If tins are the only vessels available, they must first be thoroughly coated with pitch. One pint of molasses is next stirred well into the bluestone solution. The solution is finally made slightly alkaline by the addition of a caustic soda solution prepared by dissolving 5 oz. of caustic soda in a quart of water. The caustic soda solution must be added slowly to the bluestone and molasses mixture, with constant stirring.

The above-mentioned quantities will make up about a gallon of stock solution, and should result in a slightly alkaline spray. The additional precaution of carefully adjusting the reaction of the spray may be carried out in this fashion:—

When almost all the caustic soda solution has been added, transfer a drop of the mixture to a piece of blue litmus paper. The colour of the paper should turn pink. Add more caustic soda solution until, when tested, the mixture will not change the colour of the litmus paper. A drop of the mixture should then be transferred to a piece of pink litmus paper, which will probably not change colour. Then a little more caustic soda solution is added so that eventually pink litmus paper will turn very faintly blue. (Litmus papers may be cheaply obtained from chemists.)

The stock solution so prepared should be stored in bottles or some closed non-metallic container. Since it will improve on aging, it should not be used until it is about a week old, when the colour will have changed from green to slightly yellow. In the Departmental experiments stock solution was found to be satisfactory even six to thirteen weeks after preparation.

For spraying purposes the stock solution should be vigorously agitated, and one part diluted in 30 parts of water, and 0.5 per cent. by weight of potash soft soap added as a spreader.

A formula for preparing about 8 gallons of spray is as follows:—

A.—Stock solution, 1 quart; water, 7 gallons.

B.—Potash soft soap, 6 oz.; water, ½ gallon.

When the soap has been dissolved in the water, which may be heated to save time, solution B is added and well mixed with solution A. It is advisable to pump the spray through the spray pump back into the spray vat for this purpose.

Copper Emulsion.

Considerable care is required in weighing out the materials for this spray, since an excess of bluestone (copper sulphate) will result in the formation of a sticky green precipitate, and too much soap will tend to cause spray injury. Furthermore, it is essential to use only "soft" water in its preparation.

Copper emulsion is prepared by slowly pouring a copper sulphate solution into an equal volume of a potash soft soap solution, with constant stirring, so that the spray will finally contain 0·4 per cent. copper sulphate and 2 per cent. soap by weight.

Bluestone "fines" are dissolved in water as described for the preparation of colloidal copper.

Particular care is necessary in dissolving the soap, and it is more difficult to thoroughly dissolve this substance than may at first be anticipated. If the soap is not all dissolved, the spray will contain an excess of copper sulphate, and the precipitate, mentioned above, will be formed. It is best, therefore, to dissolve it as well as possible the day before it is required, and to soak it overnight in the correct amount of water, so as to ensure that it is thoroughly dissolved before the copper sulphate solution is added.

In preparing the spray it is most important to pour the copper sulphate solution into the soap and not vice versa, since the latter process will result in the formation of the sticky precipitate. By pouring the copper sulphate into the soap solution, there is always an excess of the latter present.

Only potash soft soap should be used. In experimental work "Campbell's Genuine Potash Soft Soap" was found satisfactory for the purpose.

A formula for preparing 8 gallons of spray is as follows:—

A.—Potash soft soap, 1 lb. 10 oz.; soft water, 4 gallons.

B.—Bluestone "fines" (copper sulphate), 5 oz.; soft water, 4 gallons.

Solution B is slowly poured into solution A with constant agitation.

THE ALSATIAN—ITS ORIGIN.

Mr. James Dickie, in an article in the London "Sketch," says:—Captain A. H. Trapman, in "The Dog, Man's Best Friend," says that "the shepherd dog is neither exclusively German, Belgian, nor Alsatian, but is common to all sheep country in Central and Western Europe."

Actually, this statement seems to need some modification. The Belgian sheep dog, though like the "Alsatian" in make and shape, is smaller, stockier, and is usually all black. Both belong to the wolf-like tribe of dogs, though the Alsatian is the more wolf-like of the two, those having "Wolfshunde" blood being the most wolf-like of all.

Some difference of opinion seems to exist as to whether there is any wolf-cross in the Alsatians, or whether his wolf-like appearance is fortuitous.

The answer seems to be that there are two types of Alsatian; the pure Schaferhunde or sheep dog, and the Schaferhunde-Wolfshunde cross.

In the middle of the last century wolves and dogs were undoubtedly crossed in Germany, and Christian Burger, of Leonberg, a professional breeder, exhibited in 1887, a cross between a wolf and a dog which he called a Wolfshunde.

In 1891, however, a club was formed for the dogs now called Alsatians, and registration made difficult the further introduction of wolf blood.

To this day it is easy to pick out the dogs with wolf blood. The pure Schaferhunde is a comparatively smooth-coated dog with a straight tail level with his back, which is usually dark or black; the Wolfshunde type has a greyish and shaggier coat and a tail tending to curl over his back; he is bigger, more powerful, and more likely to be fierce, especially towards strangers, with whom, as a rule, he will have nothing to do unless properly introduced.

For this reason the Wolfshunde type of Alsatian is an exceptionally good guard; he is, of all dogs, the least likely to make friends with a burglar.

Fungicidal Experiments for the Control of Blue Mould of Tobacco.

By L. F. MANDELSON, B.Sc. Agr., Assistant Plant Pathologist.

BLUE mould or downy mildew (*Peronospora tabacina* Adam.) has always been the most serious hindrance to the successful production of tobacco in Australia. This disease has been fully discussed elsewhere[2 5], and the causal fungus of blue mould has been well described recently by Adam[1].

Investigations by Angell and Hill[2] have demonstrated that infection is carried in tobacco seed, and consequently the use of only healthy seed as well as strict attention to field sanitation has been advocated for the control of blue mould. The present general distribution of the disease, however, makes it very difficult, in large tobacco districts, to escape the disease in this manner. Hence it is very desirable to devise some efficient method for the protection of tobacco seedlings.

The use of Bordeaux mixture as a fungicide for tobacco plants has been advocated by various Agricultural Departments, but as Dickson[4] points out, the slight protection so obtained does not warrant the constant spraying which is necessary. Plants sprayed with Bordeaux mixture do not develop blue mould as quickly as unsprayed plants, but once the disease has become established they usually succumb to the disease very rapidly.

In America[3] Bordeaux mixture has also been employed recently for the control of blue mould, but the results obtained have not been entirely satisfactory.

Apparently no serious attempts have yet been made to improve the efficiency of Bordeaux mixture, or to investigate the possibilities of other fungicides for the control of this disease.

The difficulties experienced in the past in satisfactorily controlling blue mould by the use of fungicides are probably associated with three factors which tend to mitigate against their successful application. These factors are:—

1. The fine tomentose covering of the leaves of tobacco seedlings which tends to prevent actual contact with the leaf surface by sprays or dusts.
2. The leaves of young seedlings lie close to the ground, and consequently it is extremely difficult to dust or spray a fungicide on to their lower surfaces.
3. The rapid growth of the seedlings necessitates very frequent applications of fungicides in order to maintain an effective covering.

During the past two seasons experiments have been carried out with the object of overcoming these difficulties.

Since Bordeaux mixture has usually been found effective in combatting other plant diseases, it was considered likely that its efficiency as a tobacco seedling fungicide might be considerably increased if its spreading and wetting qualities were improved by the addition of

supplementary ingredients. Consequently, in the experiments now under discussion various spreading agents were used with this object in view. Various other fungicides were also tested, particular attention being given to those whose active ingredients were in a very fine state of division, since it was considered that such substances were most likely to effectively cover the leaves.

In these experiments dusts were applied with a "Feeny" dust gun, and sprays with a "Rega" 1A bucket pump fitted with a combination Bordeaux-cyclone nozzle, the sprays being applied with considerable pressure. When the seedlings were very small a fine cone-shaped spray, obtained with the cyclone outfit, was employed. A flat, fan-shaped spray, obtained with the Bordeaux section of the same nozzle, was, however, applied as soon as the seedlings were large enough. The spray rod was held at an acute angle to the ground, so that the force of the spray turned the leaves back and hit their lower surfaces. Sprays and dusts were applied first from one side of the bed and then from the other, in order to obtain a covering of fungicide on the leaves on both sides of the plants. All beds were covered with hessian directly after spraying to protect them from the effect of the sun. When dusts were applied the applications were made in the early morning. The first application of fungicides was made as soon as the majority of the seedlings were above ground unless otherwise indicated.

First Fungicide Experiment.

Seed-beds for the first and second experiments were kindly made available by the Parkridge Tobacco Plantations Pty. Ltd., and were situated about twenty miles from Brisbane.

The object of these preliminary experiments was to test several fungicides and spreading agents in order that the most promising might be more intensively investigated later.

The seed-beds were 6 feet wide and were divided into plots 5 feet long. The end plots and every third plot received no treatment. Blue mould was particularly severe in the district when these experiments were carried out, and was well established in a seed-bed about 20 feet away from the experimental plot. Consequently the beds were well exposed to natural infection.

The first application of fungicides was made on 9th December, 1932, and subsequent applications were made at seven-day intervals. The seedlings were two weeks old when operations commenced.

Fungicides Applied.

Bordeaux Mixtures.

Plot 1.—Bordeaux mixture (2-1-50) used alone.

The following seven plots were sprayed with Bordeaux mixture of this strength, together with the spreading agents indicated below:—

Plot 2.—Potash soft soap (2 per cent. of spray).

Plot 3.—"Vallo" improved casein spreader (at rate of $1\frac{3}{4}$ lb. per 100 gallons of spray).

Plot 4.—"Shell" white oil emulsion (1 per cent. of spray).

Plot 5.—Molasses (1 per cent. of spray).

Plot 6.—Linseed oil (0·5 per cent. of spray).

Plot 7.—"Vallo" benzol emulsion (1 per cent. of spray).

Plot 8.—"Agral No. 1" (0·25 per cent.). This spreader is a sulphonated aromatic derivative, which is reported to have improved the efficiency of fungicides in controlling hop powdery mildew (*Sphærotheca Humuli*)[6] and tomato leaf mould (*Cladosporium fulvum*)[8]. It has also been found to have some fungicidal value when used alone[8].

Miscellaneous Sprays.

Plot 9.—Copper emulsion. In this trial a 0·8 per cent. copper sulphate solution and a 4 per cent. potash soft soap solution were used. This fungicide is prepared by adding a copper sulphate solution to a potash soft soap solution, and probably consists in part of copper stearate. It was investigated by Dr. and Mrs. Wormald[10] in 1917 and 1918, and was found to be an effective fungicide for the control of Irish blight of potatoes (*Phytophthora infestans*) in laboratory and field trials. Its particles are in a very fine state of division.

Plot 10.—"Bouisol" at a 0·5 per cent. concentration, together with 0·5 per cent. soft soap as a spreader. This substance is a colloidal copper preparation, containing 12.5 per cent. copper.

Plot 11.—Copper sulphide. Prepared by the addition of 1 per cent. copper sulphate to lime-sulphur (1 in 40). "Vallo" improved casein spreader was added at the rate of 1¾ lb. per 100 gallons of spray.

Dusts.

Plot 12.—"Fungicidal" dust (30 per cent. copper carbonate and 30 per cent. sulphur).

Plot 13.—"Blu-Mold" dust, which contained 24·5 per cent. anhydrous copper sulphate (water content 0·2 per cent. to 0·75 per cent.). The inert substances were dried by a special treatment, and the dust was in a particularly fine state of division, being fine enough to pass through a 300-mesh sieve.

Plot 14.—"Bordodust" No. 2 (25 per cent. monohydrate copper sulphate).

Plot 15.—"Blight" dust (20 per cent. copper sulphate and 35 per cent. sulphur).

It will be noted that the dusts selected contained copper in various forms—viz., copper sulphate, monohydrate copper sulphate, anhydrous copper sulphate, and copper carbonate. Two contained sulphur as an additional active ingredient.

Results.

Blue mould was observed in some beds six days after the experiment commenced. More than likely many plants were affected prior to the first application of fungicides, since they were two weeks old at that time. The beds had not been protected from leaf miner (*Phthorimæa operculella* Zell.) damage, and consequently many plants were injured thereby.

On the 10th January, 1933, when the seedlings were a little more than six weeks old, the relative degree of control obtained with the various fungicides appeared to be in the following order:—

1. Plot No. 9.—Copper Emulsion.

During the early part of the experiment the soft soap used was unsuitable and consequently some difficulty was experienced in preparing this fungicide. A curdy precipitate was formed which clogged the spray pump, and the spray was acid in reaction. After the second application the plants were noticeably stunted and their leaves were coarser than the controls. The subsequent application caused burning of the foliage. Hence it was necessary for the fourth and following applications to reduce the copper sulphate content by half. The spreading quality of this fungicide was very good. Blue mould was observed in this plot a week later than in any other plot. Unfortunately spray injury was responsible for a poor stand of plants, but throughout the experiment this fungicide gave the best control of the disease. At the termination of the experiment on the 17th January plants in this plot were more stunted than others, but were a healthy green colour and only a few were affected with blue mould.

2. Plot No. 8.—Bordeaux Mixture and "Agral No. 1."

"Agral No. 1" was the most efficient of the spreading agents tested and resulted in a very even cover of the fungicide. This plot was consistently the best of the Bordeaux series, and blue mould did not make its appearance until the plants were five weeks old. The plants were strong and well developed, and almost twice as many plants were eventually removed from this plot into the field as from any other plot.

3. Plot No. 6.—Bordeaux Mixture and Linseed Oil.

Linseed oil was difficult to emulsify thoroughly and did not appear to improve the spreading quality of the spray. Nevertheless, notwithstanding the fact that considerable infection was present, the plants in this bed were eventually slightly better than most other Bordeaux mixture plots.

4. Plots Nos. 5, 7, 10, and 13 showed a somewhat similar degree of control.

Plot No. 5.—Bordeaux Mixture and Molasses.

Molasses did not greatly enhance the spreading quality of the spray. The spray at first did not give very promising control, but eventually appreciably checked the development of the disease.

Plot No. 7.—Bordeaux Mixture and Benzol Emulsion.

Benzol emulsion appeared to be fairly effective as a spreader, and throughout the trial this fungicide was moderately successful in controlling the disease.

Plot No. 10.—"Bouisol" and Soft Soap.

As a spray it had good spreading qualities, but the final result with this colloidal preparation was rather disappointing.

Plot No. 13.—"Blue-Mold" Dust.

This was better than other dusts in the experiment, but was not as good as many of the sprays, although at this time it was superior to four of the Bordeaux mixture preparations.

5. Plot No. 4.—Bordeaux Mixture and White Oil.

The spreader did not appear to greatly improve the spreading quality of the spray. The disease eventually became well established in this plot, but few leaves were killed, and it was superior to some other Bordeaux mixture plots.

6. Plot No. 2.—Bordeaux Mixture and Soap.

Soap considerably improved the spreading quality of Bordeaux mixture and increased its efficiency as a fungicide.

7. Plots Nos. 3 and 12 were about equally efficient.

Plot No. 3.—Bordeaux Mixture and "Vallo" Improved Spreader.

This spray appeared to spread rather well; however, by the 10th January the disease was severe in this plot, and the treatment did not seem to be as effective as other sprays where spreaders were added to Bordeaux mixture.

Plot No. 12.—"Fungicidal" Dust.

This fungicide was the least satisfactory, so far as could be observed, of the dusts tested. It, however, was eventually superior to Bordeaux mixture alone and the control plots.

8. Plot No. 1.—Bordeaux Mixture (alone).

This spray did not spread well. Blue mould was observed in the plot three weeks after it had made its appearance in the unsprayed beds, and the plants were then six weeks old. Within five days, however, the disease caused severe damage. Such a sudden decline is apparently typical with seedlings which are sprayed only with Bordeaux mixture. Eventually this was the worst of the sprayed plots, but was nevertheless better than the controls.

Other Treatments.

Both Plot No. 14 ("Bordodust No. 2") and Plot No. 15 ("Blight dust") were severely affected with leaf miner, and were abandoned prior to the termination of the experiment. Nevertheless, prior to that time these treatments were obviously not very effective in controlling the disease.

Practically all the plants in Plot No. 11 (copper sulphide) were killed by the first application of the spray.

Controls.

By the 5th January the control plots were so definitely inferior to those which had been treated that they could be distinguished from the latter from a distance. Many seedlings were eventually killed. The survivors became severely affected with the disease, and in several cases the lower leaves dried out.

Conclusions.

The results of this experiment were not very conclusive, since some infection had no doubt occurred prior to its commencement, and since

it was not desirable to artificially inoculate on a property where plants were being grown commercially, the inoculum was not uniformly distributed throughout the plots. On account of the latter some plots probably escaped infection longer than others. Blue mould was comparatively not very severe during the course of this trial.

"Blu-Mold" dust was found to be the best of the dusts tested, but not as good as many of the sprays. Of the latter copper emulsion was the most promising. Bordeaux mixture alone gave better control than anticipated, probably due to this plot escaping infection longer than most others. Once the plants did become infected they collapsed rapidly. "Agral No. 1" was found to be the most effective spreader for Bordeaux mixture, and then linseed oil, white oil, and soap, in that order.

Second Fungicide Experiment.

The beds for this experiment were planted on 11th December, 1932, but the seed germinated very poorly and they were consequently resown on 25th December. Half of each plot was covered with a mulch of pine sawdust, with the object of ascertaining whether a mulch would elevate the lower leaves and so facilitate the thorough application of fungicides. However, practically no seed germinated where a mulch had not been employed, and that half had to be again resown on 12th January, 1933.

When the seedlings were about two weeks old they were thinned out so that each seedling had at least one square inch of space.

Fungicides Applied.

The same fungicides were used and were applied to beds with respectively the same numbers as in the first experiment, with the exception of copper sulphide (Plot No. 11), which was replaced by "Shirlan H.B." at the rate of 2 lb. to 40 gallons, together with 0·25 per cent. "Agral No. 1." The active ingredient of this fungicide is salicylanilide, an organic chemical used in the cotton industry. It is reported[9] to have given satisfactory results in 1931 and 1932 in the control of tomato leaf mould (*Cladosporium fulvum*), which is considered one of the most troublesome diseases of tomatoes in England.

An additional fungicide used in this experiment was ammoniacal copper carbonate, plus 0·15 per cent. "Agral No. 1," which was applied to Plot No. 16.

Copper emulsion was prepared with 0·4 per cent. copper sulphate and 2 per cent. potash soft soap in this series.

Results.

The two sowings of seed referred to above had germinated by the 5th and 17th January respectively, and fungicides were applied shortly after the seedlings appeared. On one occasion, through neglect to cover beds after spraying during hot weather, some injury was caused to several beds.

Wet humid weather with overcast skies was experienced from the 10th to 17th, and was apparently very favourable for the development of the disease, and consequently this experiment was a severe test for the fungicides employed.

By the 17th blue mould was observed in the controls as well as several of the treated plots, and during the following fortnight became well established. At the end of that period only one control plot contained many living plants, and these were severely affected. The remaining nine controls were either devoid of plants or contained only a few diseased seedlings. At this time the seedlings were more than four weeks old.

The experiment terminated a week later on the 7th February. The various fungicides then appeared to have controlled the disease in the following order:—

1. Plot No. 2.—Bordeaux Mixture 2-1-50 plus 2 per cent. Soft Soap.

Blue mould was present on some plants, but was not so severe as in other plots. The stand was dense, but the plants were rather stunted.

2. Plot No. 5.—Bordeaux Mixture 2-1-50 plus 1 per cent. Molasses.

Blue mould was rather general, but a fair stand of large plants had survived. Some damage had been caused by leaf miner, and spray burn.

3. Plot No. 1.—Bordeaux Mixture 2-1-50 alone.

Blue mould was general and plants were definitely stunted and smaller than in other plots. Damage had also been caused by spray burn. A good stand of plants had survived.

4. Plots Nos. 8, 7, and 9.

Plot No. 8.—Bordeaux Mixture 2-1-50 plus 0·25 per cent. "Agral No. 1."

A better stand and larger plants occurred in this bed, but the degree of infection by blue mould was much the same as in the other two beds.

Plot No. 7.—Bordeaux Mixture 2-1-50 plus "Vallo" Benzol Emulsion.

The final result was a fair stand, but the lower leaves of many of the surviving plants had been damaged by blue mould and leaf miner.

Plot No. 9.—Copper Soap Emulsion (2 per cent. Soap, 0·4 per cent. Copper Sulphate).

Blue mould was severe in this bed, but plants were standing up well.

5. Plots Nos. 4 and 3.

Plot No. 4.—Bordeaux Mixture 2-1-50 plus White Oil.

A medium stand was obtained, but some injury had been caused by spray burn. The disease appeared later in this than in most plots, but once established developed rapidly.

Plot No. 3.—Bordeaux Mixture 2-1-50 plus "Vallo" Casein Spreader.

A medium stand survived in this bed, but plants were dying at the conclusion of the experiment.

Other Plots.

Plots 6 and 10 had very few plants left alive, and practically all plants were dead in the other plots, including the controls when the experiment terminated.

Conclusions.

Copper soap emulsion was not nearly so good in this trial as in the previous one. Considerable difficulty was experienced in successfully preparing this fungicide at the desired concentration, and it was only towards the end of the experiment that a suitable potash soap was obtained for the purpose. Consequently the early applications were not satisfactory, and probably accounted for the poor result obtained.

In this experiment, when blue mould was particularly severe, the various dusts used did not show any promise, and were eliminated from later trials.

Bordeaux mixture alone again gave much better results than were anticipated, and "Agral No. 1," which had been so successful in the previous experiment, did not improve its efficiency on this occasion, although the addition of this spreader gave better results than several other Bordeaux sprays. It is likely that these rather irregular results were the consequence of an uneven distribution of infection, whereby some plots escaped the disease longer than others.

In this series it was found that soft soap and molasses were the two best spreaders tested.

Third Fungicide Experiment.

On 3rd February, 1933, a bed 56 feet by 3 feet 6 inches was sown in the departmental grounds in the Brisbane Domain, in order to further and more intensively investigate the possibility of controlling blue mould by fungicides. In these experiments the seedlings were artificially inoculated with blue mould.

The object of this series was to ascertain how great a concentration of certain fungicides could safely be applied, and whether two applications a week would give better control than one.

Copper soap emulsion containing 6 per cent. potash soft soap and 1 per cent. copper sulphate was applied weekly and twice weekly. The same fungicide at twice that strength was applied at similar intervals.

Bordeaux mixture (2-1-50) plus 0·25 per cent. "Agral No. 1," and Bordeaux mixture (4-2-50) plus 0·25 per cent. "Agral No. 1" was also applied weekly and twice weekly.

Other plots were sprayed weekly with Bordeaux mixture (2-1-50) alone, and with 1 per cent. molasses as a spreader. A gasworks product known as "Ammon Cent" was also tested.

Every third plot received no treatment and was used as a control. Each plot was 3 feet 6 inches square.

The first signs of germination were observed on 9th February. The beds were kept covered with hessian and the plants produced were consequently small, spindly, and soft. They were readily damaged by fungicides which were at all severe, and were very susceptible to blue mould infection.

The first application of fungicides was made on 21st February, twelve days after germination.

The plants were artificially inoculated two days and four days later. The inoculum was prepared by agitating affected leaves bearing large quantities of spores in a can of water. The spore suspension was

then applied to the seedlings with a watering-can, and the hessian curtains soaked with water to increase the humidity in the vicinity of the seedlings.

Results.

The first application of copper soap emulsion at double strength killed about 90 per cent. of the seedlings, and very few survived the second application.

Likewise, double-strength Bordeaux mixture caused considerable damage and about half the plants were killed by the first application. Even normal strengths of fungicides in some cases caused damage to the extremely weak seedlings used in this experiment.

Blue mould was observed on 6th March, and the disease developed very rapidly. Ten days later there were practically no living plants remaining in the control plots.

The experiment was completed on the 22nd March, when the seedlings were six weeks old. On this date the plot sprayed twice a week with the weaker strength of copper soap emulsion was the best plot. The same fungicide applied once a week was next best, notwithstanding the fact that in both cases a considerable degree of damage had been caused by spray burning. The plot sprayed with Bordeaux (2-1-50) plus "Agral No. 1" produced the greatest number of plants, but showed a certain amount of blue mould infection.

Most of the seedlings were killed by the double-strength Bordeaux mixture, and those which survived became affected with blue mould.

Blue mould was observed in the plot sprayed with Bordeaux mixture (2-1-50) alone on 16th March. The following day the plants were producing large quantities of spores, and within five days practically all the seedlings had been killed by the disease.

The addition of molasses did not greatly improve Bordeaux mixture on this occasion, and at the termination of the experiment this plot was only slightly better than that sprayed with Bordeaux mixture alone.

No spray damage was caused by "Ammon Cent," but this plot fared just as badly as the controls after the advent of blue mould.

Conclusions.

The conditions under which the plants were grown in this experiment made the test very rigorous, and demonstrated the considerable fungicidal value of copper soap emulsion. Two applications of fungicides per week gave better control than one. Double-strength Bordeaux mixture and both strengths of copper soap emulsion used were too concentrated and damaged the tender tobacco seedlings used in this experiment.

Fourth Fungicide Experiment.

On 11th March, 1933, another bed similar to that used in the preceding experiment was sown at the Brisbane Domain. The seed commenced to germinate six days later. On this occasion the lower edge of the storm curtain was raised about 18 inches above the level of the bed. In this way the seedlings were at all times protected from direct sunlight, but were well aerated.

The objects of the experiment were—

(*a*) To observe the effect of greater concentrations of "Agral No. 1" and soft soap than had previously been used, as spreaders for Bordeaux mixture. For this purpose the concentration of "Agral No. 1" was increased to 0·25 per cent. and that of soft soap to 2 per cent.

(*b*) To endeavour to obviate the difficulties involved in preparing copper emulsion by adding an additional 0·5 per cent. of soft soap.

(*c*) To ascertain the importance of the method of application of sprays. For this purpose Bordeaux mixture with "Agral No. 1" was applied only with a rose nozzle, directing the spray stream at right angles to the surface of the bed, and was compared with another plot which was sprayed with the same fungicide applied with a rose nozzle when the plants were small, and with a flat spray applied at an acute angle when the plants were well established.

(*d*) To observe the effect of thinning out the beds on the efficiency of the fungicides applied. When the seedings were about three weeks old, the selected beds were thinned out so that each plant occupied 4 square inches of bed. Beds treated in this manner included one each sprayed with copper emulsion and Bordeaux mixture with "Agral No. 1" at the usual strengths, as well as a control plot.

(*e*) To test out a home-made colloidal copper[7] with a 0·4 per cent. copper sulphate content, together with 0·5 per cent. soft soap as a spreader. "Bouisol," a colloidal copper compound, had not been found very satisfactory in the preliminary series, but it seemed desirable to persevere with a fungicide in a fine state of division, and it was considered that home-made colloidal copper might give better results with a greater concentration of copper. Details for the preparation of this spray are given in the article "Additional Recommendations for the Control of Blue Mould of Tobacco," which appears elsewhere in this issue of the "Queensland Agricultural Journal."

Bordeaux mixture (2-1-50) alone and with 1 per cent. molasses, as well as the usual control plots, were included for comparative purposes. Fungicides were applied twice weekly. The beds were artificially inoculated with blue mould on the 25th, 26th, and 27th March, and the disease made its appearance nine days after the first inoculation. The weather was overcast and wet during a considerable portion of the period under review. During the first five days of April, 816 points of rain were recorded. Conditions subsequently were very favourable for the development of blue mould, and during the latter portion of April it was extremely severe.

Results.

Practically all the plants in the control beds were killed ten days after blue mould was first observed.

Bordeaux mixture (2-1-50) alone delayed the development of the disease about a week in comparison with the controls, but the majority of plants in this bed were killed within eight days from the time the disease appeared.

The efficiency of Bordeaux mixture was considerably improved by the addition of 1 per cent. molasses. Blue mould was not observed in this plot until fourteen days after it had appeared in the controls. Six days later, when the plants were five weeks old, some were being killed by the disease, but at that time the plot was the second best in the series.

The addition of "Agral No. 1" to Bordeaux mixture delayed the development of blue mould for fourteen days, as in the case of molasses. Within a week after the disease had been observed, however, practically all plants had been killed.

Some spray injury was caused when 0·25 per cent. "Agral No. 1" or 2 per cent. soft soap was added to Bordeaux mixture. The latter furthermore stunted the seedlings and produced an objectionable caking on the surface of the soil.

Bordeaux mixture and "Agral No. 1" sprayed with a rose nozzle was not as effective as when applied with a flat spray. The majority of the seedlings treated in this manner were killed four days after the advent of the disease.

The addition of excess soap (i.e., 2·5 per cent. as compared with 2 per cent.) in the preparation of copper emulsion caused spray injury. On the 24th April the bed sprayed with normal strength copper emulsion had a 70 per cent. stand, whereas only three or four plants were left on that date in the bed sprayed with this fungicide plus excess soap.

Thinning out the plants to one to each four square inches did not increase the efficiency of the sprays applied. On the contrary, beds treated in this manner fared considerably worse than those which were not thinned out. The spores of the causal fungus of the disease would no doubt have been very thoroughly spread throughout the plots during the thinning-out process, and this would to some extent account for the result. Furthermore, owing to low temperatures at this time of the year the seedlings made very slow growth, and consequently were not sufficiently crowded, in beds which were not thinned out, to interfere with the application of fungicides.

Home-made colloidal copper and soft soap was very successful as a fungicide. Plants in this plot were apparently free from infection on 24th April, three weeks after the development of blue mould in the control plots. The plants were, however, rather stunted.

At the conclusion of the experiment the efficiency of the various treatments was estimated to be in the following order:—

1. Colloidal copper plus 0·5 per cent. soft soap.
2. Bordeaux mixture (2-1-50) plus 1 per cent. molasses.
3. Copper emulsion (normal strength).
4. Bordeaux mixture (2-1-50) plus 0·5 per cent. soft soap.
5. Bordeaux mixture (2-1-50) plus 0·2 per cent. "Agral No. 1."

During the latter part of this experiment the weather was cool and the plants consequently ceased growing. It was, therefore, decided to postpone any further spraying experiments until the spring months.

Conclusions.

These experiments confirmed the view that the manner in which the fungicides are applied is of considerable importance. Greater concentrations of soft soap or "Agral No. 1" than had previously been used as spreaders were found to be not advantageous. Furthermore it was apparently not advisable to increase the percentage of soap in copper emulsion if the plants were at all delicate.

The most important result of this series was the indication that home-made colloidal copper was a promising fungicide for the control of blue mould. From the practical point of view this was of considerable interest, because this fungicide could be easily and cheaply prepared, and was convenient to use.

Fifth Fungicide Experiment.

The seed-bed for this experiment was sown on 15th August, 1933. Even then the weather was cool and the seed did not commence to germinate until seventeen days later. It was difficult to arrange for the seedlings to be properly "hardened off" during these experiments, but on this occasion it was found possible to expose the plants to direct sunlight for three hours in the morning and for two hours in the afternoon.

The objects of this experiment were:—

1. To further investigate the possibilities of home-made colloidal copper at the same concentration as used previously, since this fungicide was very promising in the fourth experiment.

   (*a*) The fungicidal values of old and freshly prepared stock solutions of colloidal copper were compared. The former was prepared six weeks prior to the first applications of fungicides in this series, and the latter was three days old when each application was made.

   (*b*) A comparison was made of Bordeaux mixture (2-1-50) and colloidal copper with the addition of three spreaders, viz., "Agral No. 1," "Actin," and soft soap. "Actin" was a new proprietary spreading agent which had only recently been made available. The stock solution for the colloidal copper was six weeks old.

2. To investigate the value of copper emulsion at half the usual strength (i.e., 0·2 per cent. copper sulphate and 1 per cent. soap), in order to obviate caking the soil surface which had been previously experienced with the fungicide at the normal strength. Bordeaux mixture (2-1-50), both with 1 per cent. molasses and without a spreader, were included for comparative purposes.

The fungicides were applied every four or five days, and the first application was made on the 6th September.

The beds were artificially inoculated on 13th and 14th September. During the experiment the weather was overcast or showery and humid, for the greater part, especially subsequent to the 24th September, and was ideal for the development of blue mould.

Results.

Blue mould was observed in the control beds on 23rd September, and on the 25th they were severely affected. The weather at this time was very favourable for the disease and within twenty-four hours a third of the plants were dead and collapsed. Seven days later there were no living plants in the control beds.

All the sprayed plots were observed to be affected on 26th September. Shortly afterwards the copper emulsion plots appeared to be best, the colloidal copper plots second, and the Bordeaux mixture were not quite so good. This order was not maintained throughout the experiment.

In order to roughly estimate the relative values of the various treatments, all plants were removed in a strip three inches wide running diagonally across each bed, when the plants were six weeks old, and a count was made of all healthy plants so removed. The counts from the best six beds were as follows:—

Colloidal copper and "Actin" yielded 87 healthy plants.

Copper emulsion (normal strength) yielded 78 healthy plants.

Copper emulsion (half strength) yielded 64 healthy plants.

Bordeaux mixture and "Agral No. 1" yielded 62 healthy plants.

Bordeaux mixture and "Actin" yielded 59 healthy plants.

Colloidal copper and soap yielded 49 healthy plants.

The final inspection was made when the plants were seven weeks old, and at that time they were placed in the following order:—

1. Bordeaux mixture (2-1-50) and "Agral No. 1."
2. Colloidal copper and soft soap.
3. Colloidal copper and "Actin."
4. Bordeaux mixture (2-1-50) and "Actin."
5. Copper emulsion (full strength).

The other plots then had either no plants or very few living plants left.

This alteration of the relative condition of the various plots was not uncommon during the course of these experiments. It is of interest, furthermore, to note that some weeks after spraying had ceased there were many more plants surviving in the plot sprayed with colloidal copper and soap than in any other plot.

Conclusions.

It was found that colloidal copper spray prepared from stock which was at least six weeks old gave better results throughout the experiment than that made from a freshly prepared stock. It was, however, considerably improved by the addition of a spreader.

Bordeaux mixture and "Agral No. 1" was the best plot in the series at the end of the experiment, and was much better than colloidal copper with the same spreader. This result is not in agreement with other comparisons made in this series with these two fungicides. A

possible explanation is that the colloidal copper bed had suffered more than the other plots from the excessive wet weather, which saturated the soil for several days.

Colloidal copper and "Actin" gave better results than Bordeaux mixture and "Actin."

Colloidal copper and soft soap proved superior to Bordeaux mixture with the same spreader. The former did not cause any stunting such as was observed in the previous experiment. It was considered the second best plot when the final observations were made, whereas very few plants were left alive in the plot treated with Bordeaux mixture and soft soap.

Half strength copper emulsion caused considerably less caking of the soil than the same fungicide used at full strength, but as a fungicide it was considerably inferior to the latter.

The copper emulsions were very disappointing at the latter part of this experiment. Until the plants were a little more than a month old, the full strength copper emulsion was the best plot, and the half strength the fifth best. Later, however, as indicated above, they were inferior to several other treatments. Full strength copper emulsion had not previously been found inferior to Bordeaux and "Agral No. 1." The contradictory result on this occasion may have been due to the uneven distribution of the inoculum, since the controls in the vicinity of the former were more severely affected than those in the vicinity of the latter.

The same explanation is probably applicable in comparing Bordeaux mixture alone and the same fungicide plus molasses. The latter was throughout this experiment the worst of the treated plots, whereas previous experiments had indicated that molasses would appreciably improve the efficiency of Bordeaux mixture.

Sixth Fungicide Experiment.

The beds were sown on 5th October, 1933, in this experiment, and the first signs of germination were noted ten days later.

The objects of this series were:—

(1) To further investigate the fungicidal value of home-made colloidal copper by comparing beds sprayed with this fungicide with others sprayed with Bordeaux mixture. Colloidal copper (copper content equivalent to 0·4 per cent. copper sulphate) and Bordeaux mixture (2-1-50) used alone, as well as the same fungicides with 0·2 per cent. "Agral No. 1" and with 0·5 per cent. soft soap as spreaders, were employed.

(2) To further test the fungicidal value of colloidal copper and "Actin."

(3) Since half strength copper emulsion had not caused any appreciable caking of the soil but was unsatisfactory as a fungicide in the last experiment, copper emulsion was now tried at three-quarters strength (0·3 per cent. copper sulphate and 1·875 per cent. soft soap), and was compared with normal strength copper emulsion.

(4) To test two proprietary fungicides, viz., "Kwik-Kure" Bordeaux and "Shell Anti-Mildew Spray." The latter was a white oil preparation.

The fungicides were applied twice weekly, and the first application was made on 17th October. The beds were artificially inoculated on the 23rd and 24th October.

During the period of this experiment, the weather conditions were even more favourable for blue mould infection than during the fifth experiment. For the greater part of the time it was either raining or overcast. The soil of the seed-beds was saturated and the ground in the vicinity was partly under water.

Results.

Blue mould was fairly generally distributed throughout the seed-bed on 31st October, sixteen days after the commencement of the experiment. The inoculum had apparently been unevenly distributed, since at this time the plants in one control seed-bed, which were very small and consequently difficult to examine, were apparently healthy, whereas those in the other four control plots were affected. The majority of plants in the latter were flaccid as a result of blue mould infection, and some had been killed. By 7th November half the seedlings in the control plots were dead, and during the next three days practically all were destroyed.

The majority of the sprayed plots were seen to be affected with blue mould when the disease was first observed in the controls. On this occasion, owing to the very rigorous conditions under which the experiment was carried out, the Bordeaux mixture sprays were not very effective in controlling the disease. Colloidal copper and copper emulsion, however, were both comparatively good.

When the plants were four and a-half weeks old, the relative efficiency of the various fungicides appeared to be as follows:—

1. Colloidal copper and soft soap.
2. Colloidal copper and "Agral No. 1."
3. Copper emulsion (full strength).
4. Colloidal copper alone.
5. Colloidal copper and "Actin."
   Copper emulsion (three-quarters strength).
6. Bordeaux mixture and "Agral No. 1."
7. "Shell Anti-Mildew Spray."

Seedlings in the other plots had been destroyed by blue mould.

Upon the completion of the experiment on 14th November, blue mould was present to some extent in every plot. With the exception of one of the colloidal copper and soap plots, in which only a few leaves were killed, some plants had been destroyed by the disease in

every case. The degree of mortality varied from about 5 per cent. in one colloidal copper and soap plot to 100 per cent. in some Bordeaux mixture plots and in the controls. In the Bordeaux mixture and "Agral No. 1" plot about a dozen plants survived.

Conclusions.

Home-made colloidal copper with soft soap as a spreader was found to be the most efficient spray used in this experiment. Soft soap was slightly superior to "Agral No. 1" as a spreading agent for this fungicide, and "Actin" was not satisfactory. Normal strength copper emulsion was comparatively satisfactory, but the weaker strength was not. All Bordeaux mixture sprays gave disappointing results on this occasion. "Agral No. 1," however, increased the efficiency of this fungicide to a greater extent than soft soap. The proprietary fungicides tested were not effective in controlling the disease.

Discussion of the Results Obtained in the Six Experiments.

The results obtained with all the fungicides tested are briefly summarised in the following tables. As has been indicated above, these trials were carried out at various times of the year under variable weather conditions, and the manner in which the plants were raised also varied for the different experiments. In some the seedlings were naturally infected and in others they were artificially inoculated, but even in the latter case it was apparently difficult to evenly distribute the inoculum throughout the bed. Consequently the somewhat contradictory results which at times were obtained with some fungicides may partly be explained by these factors.

The results, however, tend to indicate that—

1. The fungicidal dusts tested were not satisfactory.
2. Bordeaux mixture without a spreading agent was not effective. When seedlings were grown under field conditions, more satisfactory results were obtained by the addition of either "Agral No. 1," soft soap, or molasses. In the more rigorous tests fair results were sometimes obtained with these spreaders or with "Actin." "Agral No. 1" was the most efficient spreader tested with this fungicide.
3. Copper emulsion gave variable results, but when used at the normal strength was fairly good.
4. Home-made colloidal copper with soft soap was consistently good, and was the most promising fungicide tested. Unfortunately, however, it was only possible to test it in three experiments. Satisfactory results with it were also obtained at times when "Agral No. 1" or "Actin" was used as a spreader, the former being more efficient than the latter. Colloidal copper was not very satisfactory when used without the addition of a spreading agent, but even so was slightly better than Bordeaux mixture.

TABLE I.

Summary of Results of Trials with Fungicides for Control of Blue Mould of Tobacco.

(*N.B.*—Notes on environmental conditions when fungicides were applied, and manner of infection appear at foot of table.)

Fungicide.	Experiment.	Days after first spraying when disease observed.	Age of Seedlings when disease observed.	Degree of Control.	Remarks.
			Days.		
"Fungicidal dust" ..	1	21	35	Poor ..	Gave better control than Bordeaux mixture alone, but not as good as other dusts tested.
Ditto	2	12 (fairly severe)	12	ditto	Practically all plants dead when experiment terminated.
"Blu-mold" dust ..	1	21	35	Fair ..	Best of dusts and better than some Bordeaux sprays. Checked development of disease to some extent.
Ditto	2	14	14	Poor ..	Practically all plants dead when experiment terminated.
"Bordo-dust" ..	1	21	35	ditto	Slightly better than Fungicidal dust. Plot abandoned after 32 days in consequence of severe leaf miner damage.
Ditto	2	14 to 21	14 to 21	ditto	Practically all plants dead when experiment terminated.
"Blight dust" ..	1	21	35	ditto	Leaf miner so severe as to make observations uncertain. Plot abandoned after 32 days.
Ditto	2	..	..	ditto	No plants in plot 14 days after germination. Time of infection not observed.
Copper sulphide ..	1	..	..	..	Complete failure. Plants killed by spray.
Ammoniacal copper carbonate + 0·15 per cent. "Agral No. 1"	2	..	..	Poor ..	No better than dusts in this experiment. No plants in plot 14 days after germination. Time of infection not observed.
0·5 per cent. "Shirlan HB" + 0·25 per cent. "Agral No. 1"	2	12 (well established)	12	ditto	No better than dusts in this experiment. Applied weekly. Normal conditions for growth. Weather favourable for disease.
"Shell Anti-mildew spray"	6	21	23	ditto	Disease observed in adjoining control plot four days previously. Plants in sprayed plot very stunted as result of spray injury. The smallness of seedlings made observations difficult, and the disease may have been present before being observed.
0·5 per cent. "Bouisol" + 0·5 per cent. soap	1	21	35	Fair ..	Plants well developed. Controlled disease better than Bordeaux mixture alone or with some spreaders. Good spreading quality.
Ditto	2	12	12	Fair ..	Disease well established when experiment terminated.
Ammon cent.	3	20	32	Nil ..	Applied weekly. Spray did not spread well.
Bordeaux mixture (2-1-50) alone	1	27	41	Poor ..	Plants became severely affected within five days after disease observed. Finally worst plot. Controls affected six days after experiment commenced.
Ditto	2	26	26	Fair ..	Third best of Bordeaux sprays. Controls well affected twelve days after experiment commenced. Plants stunted and some spray injury.
Ditto	3	20	32	Poor ..	Applied weekly. Practically all seedlings killed by disease within week after observed.
Ditto	4	24	24	ditto	95 per cent. of plants killed within week and all dead within ten days from time when disease observed.
Ditto	5	19	25	ditto	Very few plants left at end of experiment, but better than some Bordeaux sprays with spreaders. (?)Uneven distribution of inoculum. Thirty-eight plants from strip.
Ditto	6	14	16	ditto	Slightly better than "Kwik-Kure" Bordeaux mixture.

TABLE I.—*continued.*

Summary of Results of Trial with Fungicides for Control of Blue Mould Tobacco—*continued.*

Fungicide.	Experiment.	Days after first spraying when disease observed.	Age of Seedlings when disease observed.	Degree of Control.	Remarks.
			Days.		
"Kwik-Kure" Bordeaux mixture	6	14	16	Poor ..	Plants were severely affected when disease was first observed. Worst plot in experiment.
Bordeaux mixture (2-1-50) + "Vallo" improved spreader	1	21	35	ditto	Checked development of disease better than Bordeaux mixture alone. Spray spread well.
Ditto	2	12	12	Fair ..	Weather favourable for disease. Plants dying when experiment terminated. Plot affected as soon as controls.
Bordeaux mixture (2–1–50) + 1 per cent. "Shell White Oil"	1	21	35	ditto	Fair spreading qualities. Fungicide not as good as Bordeaux mixture and soap.
Ditto	2	26	26	ditto	Disease developed rapidly once established. Some spray injury.
Bordeaux mixture (2-1-50) + 1 per cent. molasses	1	21	35	ditto	Fair spreading qualities. Checked development of disease after it was rather well established.
Ditto	2	26	26	Good ..	Second best plot in experiment. Some spray injury
Ditto	3	20	32	Poor ..	Applied weekly. Plants declined rapidly; most died in three days after disease established. Nevertheless checked disease development more than Bordeaux alone. Less spray injury than in other plots.
Ditto	4	32	32	Good ..	Best of Bordeaux sprays, but plants were rapidly dying when experiment terminated.
Ditto	5	18	24	Poor ..	No plants left at end of experiment. Worst of treated plots throughout experiment. Not as good as Bordeaux alone. (?)Uneven distribution of inoculum.
Bordeaux mixture (2–1–50) and 0·5 per cent. linseed oil	1	21	31	Fair ..	Poor spreading quality. Oil difficult to emulsify. Gave slightly better results than most Bordeaux sprays.
Ditto	2	19	19	Nil ..	A poor stand of plants in this bed throughout experiment and finally no better than controls.
Bordeaux mixture (2–1–50) and 1 per cent. benzol emulsion	1	27	41	Fair ..	Spread fairly well.
Ditto	2	12	12	ditto	Better results than obtained with Bordeaux and white oil.
Bordeaux mixture (2–1–50) and 0·25 per cent. "Agral No. 1"	1	27	41	Good ..	Most efficient spreader tested. Best of Bordeaux sprays and second best in experiment.
Ditto	2	12	12	Fair ..	Some damage caused by leaf miner.
Ditto	3	20	32	Poor ..	Applied weekly. Only few plants left at end of experiment. Not as good as when applied twice weekly.
Ditto	3	20	32	Good ..	Applied twice weekly. One of the best plots. Produced most plants, but more disease in this plot than in some others.
Ditto	4	32	32	Fair ..	More spray injury than when 0·2 per cent. "Agral No. 1" used.
Bordeaux mixture (2–1–50) and 0·2 per cent. "Agral No. 1"	4	32	32	ditto	Degree of control not affected by lower concentration of "Agral No. 1."
Ditto	4	32	32	Poor ..	Plants spaced 1 to 4 sq. in. Practically no plants left at end of experiment.
Ditto	4	32	32	ditto	Sprayed only with mist spray. Plants collapsed in three days after disease established.
Ditto	5	19	25	Good ..	Plants not properly hardened off. Best plot. Relative position improved during latter portion of trial. Sixty-two plants from strip.
Ditto	6	14	16	Poor ..	Best of Bordeaux mixture plots. "Agral No. 1" superior to soft soap in this experiment.

TABLE I—*continued.*

Summary of Results of Trials with Fungicides for Control of Blue Mould of Tobacco—*continued.*

Fungicide.	Experiment.	Days after first spraying when disease observed.	Age of Seedlings when disease observed.	Degree of Control.	Remarks.
			Days.		
Bordeaux mixture (2-1-50) and 0·025 per "Actin"	5	19	25	Fair ..	Spread well. Result not as good as with colloidal copper and "Actin." Fifty-nine plants from strip.
Bordeaux mixture (4–2–50) and 0·25 per cent. "Agral No. 1"	3	20	32	..	Two applications per week. Severe spray burning. Practically no plants left after seventh application.
Ditto	3	20	32	Fair ..	Applied weekly. Severe spray injury and few plants left when trial terminated.
Bordeaux mixture (2-1-50) and 2 per cent. soap	1	21	35	ditto	Spread well. Checked disease better than Bordeaux alone.
Ditto	2	12	12	Good ..	Best plot in experiment. Plants rather stunted. Natural infection.
Ditto	4	32	32	Fair ..	Growth of seedlings adversely affected and soil caked by soap.
Bordeaux mixture (2-1-50) and 0·5 per soap	4	32	32	ditto	Final result better than when 2 per cent soap used. Many plants being killed at termination of experiment.
Ditto	5	19	25	Poor ..	Not as good as Bordeaux alone, and few plants left at termination of experiment. Sixteen plants from strip.
Ditto	6	14	16	ditto	Soft soap slightly increased the efficiency of Bordeaux mixture.
Copper emulsion, 0·8 per cent.—4 per cent.	1	32	45	Good ..	Spreading qualities good. Gave best control. Soap unsatisfactory and $CuSO_4$ content reduced by half after fourth application. Plants stunted, foliage coarsened and burnt. Infection slight.
Copper emulsion, 0·4 per cent. to 2 per cent.	2	12	12	Fair ..	Plants well developed.
Ditto	4	32	32	Good ..	Comparable with Bordeaux and molasses in this experiment.
Ditto	4	32	32	Poor ..	Plants spaced 1 per 4 sq. in. Few plants left at end of experiment, but better results than with Bordeaux and "Agral No. 1" plot treated in same manner.
Copper emulsion, 0·4 per cent.-2·5 per cent.	4	32	32	ditto	Only three or four plants survived. Damage mostly caused by spray injury.
Ditto	5	19	25	Fair ..	Was best plot, but deteriorated during latter fortnight of trial. Seventy, eight plants from strip.
Ditto	6	14	15	Good ..	Better than colloidal copper when no spreader was added to latter.
Copper emulsion, 1 per cent.-6 per cent.	3	29	41	(?) Good	Two applications per week. Almost a plants had been killed by spray before disease developed in other sprayed plots. Very few survivors affected with disease.
Ditto	3	27	39	(?) Good	Weekly applications. Few plants left as result of spray injury. but relatively good control of disease.
Copper emulsion, 2 per cent.-12 per cent.	3	..	..	..	Practically all plants killed by spray after second application. Weekly applications.
Ditto	3	..	..	..	Two sprayings per week. Practically all plants killed by second application.
Copper emulsion, 0·2 per cent.-1 per cent.	5	19	25	Poor ..	Not as good as normal concentration. Less caking of soil. ..
Copper emulsion, 0·3 per cent.-1·875 per cent.	6	14	16	Fair ..	Strength not sufficient to protect plants under rigorous conditions.
Home-made colloidal copper and 0·5 per cent. soap	4	Free of disease at end of experiment		Good ..	Best plot. Plants very stunted.
Ditto	5	19	25	ditto	Second best plot. Superior to all other plots subsequent to termination of experiment. Well developed plants. Forty-nine plants from strip.

TABLE I.—*continued.*

Summary of Results of Trials with Fungicides for Control of Blue Mould of Tobacco—*continued*

Fungicide.	Experiment.	Days after first spraying when disease observed.	Age of Seedlings when disease observed.	Degree of Control.	Remarks.
			Days.		
Ditto ..	A.	24	26	Good ..	Best plot in experiment. Some plants not affected and none killed at termination of experiment. Infection not so severe at the end of bed where this plot was located.
Ditto ..	B	15	17	ditto	Some plants were healthy and only about 5 per cent. were killed at conclusion of trial.
Colloidal copper and 0·2 per cent. "Agral No. 1"	5	19	25	Poor ..	Not as good as Bordeaux and "Agral No. 1." Few plants left when experiment terminated. Forty-one plants from strip.
Ditto	6	15	17	Good ..	Not quite as good as colloidal copper and soap, but considerably superior to Bordeaux and "Agral No. 1."
Colloidal copper and 0·025 per cent. "Actin"	5	19	25	ditto	Amongst best plots and gave highest count of plants from strip (viz. eighty-seven).
Ditto	6	14	16	Fair ..	Comparable with three-quarter strength copper emulsion. "Actin" did not improve the efficiency of fungicide, and was inferior to soap or "Agral No. 1."
Colloidal copper (alone)	5	18	24	Poor ..	Made from stock solution *not more than three days old*. Not as good as spray from mature stock solution. Better than Bordeaux alone during experiment. No plants left finally. Twelve plants from strip.
Ditto	5	11	25	ditto	Few plants left at termination of experiment. Thirty-eight plants from strip.
Ditto	6	21	23	Fair ..	Plants were more stunted than those in adjoining plot sprayed with colloidal copper and soap.

TABLE II.

Control Plots.

Experiment.	Age of Seedlings when Disease Observed.	Remarks.
	Days.	
1	21	Some plants were killed by blue mould when six weeks old. In most cases only lower leaves were killed.
2	12	Seedlings were severely affected when three weeks old, and majority were dead a week later. Practically no plants survived the period of the experiment.
3	26	Blue mould was observed fourteen days after inoculation and within a week practically all plants were killed by the disease.
4	17	Blue mould was observed nine days after inoculation. Some plants were killed during the following week, and practically all were destroyed within four weeks from date of germination.
5	17	Blue mould was observed ten days after inoculation. During the following forty-eight hours the seedlings became severely affected, and all were dead within nine days from the time the disease was observed.
6	15	Blue mould was observed seven days after inoculation. Within twenty-four hours most plants were severely affected and some were killed. During the subsequent ten days practically all plants were killed. Owing to uneven distribution of inoculum, some plots were destroyed earlier.

Explanatory Notes.

The plants in Experiment I. were exposed only to natural infection, and were grown under normal field conditions at Parkridge. All fungicides were applied once a week. Environmental conditions were not so favourable for the disease as in the other experiments.

In the case of Experiment II. the plants were also exposed only to natural infection, and were grown under normal field conditions at Parkridge. All fungicides were applied once a week. Weather conditions during the experiment were very favourable for the development of blue mould.

In Experiments III., IV., V., and VI. the inoculum was applied artificially and the plots were situated in the departmental grounds in the Brisbane Domain.

In Experiment III. the plants were grown under hessian, which was closely attached to the sides of the bed throughout the experiment. Consequently plants were small, spindly, and soft, and predisposed to disease and spray injury. Fungicides were applied at times indicated in the tables.

In Experiment IV. the seed-bed was covered with hessian, the lower edge of which was permanently fixed about 18 inches above the level of the bed. Hence better aeration and more indirect sunlight were obtained than in Experiment III., but conditions nevertheless were more conducive to infection than occur in normal field practice. Sprays were applied twice weekly.

In Experiment V. the seedlings were partially "hardened off" by being exposed to sunlight for about three hours in the forenoon and for two hours in the afternoon. Fungicides were applied every four or five days. All plants in a strip three inches wide running diagonally across each bed were removed when six weeks old and a count was made of all healthy seedlings.

In the case of Experiment VI. the seedlings were grown under similar conditions as in Experiment V. Fungicides were applied every four or five days. The weather was either wet or overcast for the greater portion of the period of the experiment, and during this time the soil of the bed was saturated. Conditions were consequently ideal for blue mould infection.

All plants were removed in a strip running diagonally across each bed when they were six weeks old, and a count was made of all healthy seedlings.

Field Tests with Copper Emulsion Spray.

It had been found practically impossible at the latter end of 1932 to raise tobacco seedlings at the Parkridge Tobacco Plantations Pty., Ltd., owing to the severity of blue mould in the district.

At the conclusion of the first experiment discussed herein, which was carried out on this property, the manager of the company was so impressed with the results obtained with copper emulsion spray that he used it as a general practice on all seedlings growing on the plantation.

The same method of applying the fungicide was employed as had been used on the experimental plots, and both healthy and diseased seedlings were sprayed. The strength of the fungicide was increased

to the equivalent of 3·1 per cent. soft soap and 0·55 per cent. bluestone. Very small seedlings were sprayed once a week, but rapidly growing seedlings received two or three applications weekly.

Sufficient seedlings were obtained in this manner to supply the need of the company, and eventually forty-eight acres were planted with tobacco. This satisfactory result was not associated with favourable environmental conditions. On the contrary the weather was apparently

Plate 129.

Seed-beds on Parkridge Tobacco Plantations Pty. Ltd. property planted on same date as that shown in Plate 131 and situated about half a mile distant from it. The seedlings were only slightly affected when transplanted to the field. Sprayed with copper emulsion.

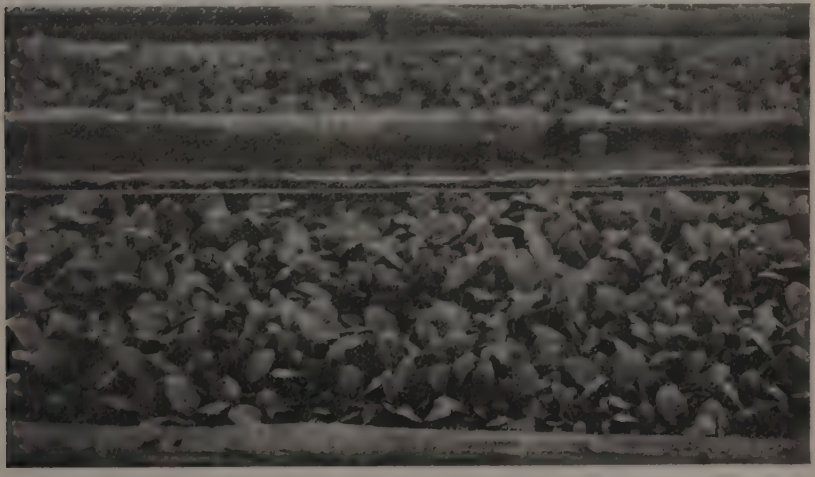

Plate 130.

A closer view of seedlings shown in Plate 129. Sprayed with copper emulsion.

conducive to blue mould infection, since the control plots of the second preliminary experiment, which were growing on this property at the same time, were completely destroyed.

The City Boundary Estates, another tobacco company in the Parkridge district, also used copper emulsion containing 2 per cent. soft soap and 0·4 per cent. copper sulphate during the 1932-33 season. Blue mould was successfully controlled thereby while the fungicide was regularly applied, and a considerable acreage of tobacco was eventually planted out.

On the 6th September, 1933, five beds 150 feet by 4 feet were planted at the Parkridge Tobacco Plantations Ltd. The seedlings were sprayed with copper emulsion containing 3·1 per cent. soft soap and 0·47 per cent. copper sulphate thirteen days after germination. Subsequent applications were made weekly for the first three weeks and thereafter twice weekly. The seedlings were not thinned out, and the beds were so overcrowded when the plants were six weeks old that the dense stand of plants completely occupied the bed space. The beds were situated on the lowest situation on the property on the border of a swamp.

PLATE 131.

Tobacco seed-bed eleven days after plants had been completely destroyed by blue mould. The only vegetation in bed consisted of weed growth. Not sprayed with copper emulsion.

Notwithstanding the fact that the density of the stand of plants made efficient spraying difficult, and the situation of the beds and the prevailing weather conditions were conducive to the development of blue mould, the disease was satisfactorily controlled. Blue mould was observed in two of the beds when the seedlings were four weeks old. During the following three weeks the disease spread throughout the five beds, but the plants were only slightly affected and none were killed. Several acres of tobacco were eventually planted up from these beds.

A seed-bed was sown on the adjoining farm, situated about half a mile from the abovementioned beds, on approximately the same date, and was dusted with various fungicidal dusts. When the seedlings were

five and a-half weeks old they were observed to be affected with blue mould, and all plants were completely destroyed within twenty-four hours. Plate 131 contrasts the condition of this bed with beds sown on approximately the same date at the Parkridge Tobacco Plantations Ltd. This company also planted eleven other similar beds, six of which were five weeks old and five were two weeks old when inspected on the 8th November. They were also sprayed with copper emulsion, and were apparently free of infection on that date.

A private grower in the Parkridge district also used copper emulsion during 1933 with considerable success. This spray was of normal strength, containing 2 per cent. soft soap and 0·4 per cent. copper sulphate. His beds were inspected on the 8th November. On this date only one bed was affected with blue mould. This bed was 90 feet by 3 feet, and the seedlings were eight weeks old. Blue mould had been observed twelve days prior to the date of inspection, and an area about 4 feet in diameter was affected. All other beds were apparently healthy. One bed about 20 feet by 3 feet contained plants ten weeks old, other beds 27 feet by 4 feet and 45 feet by 3 feet contained plants six weeks and three weeks old respectively.

So far as could be ascertained, practically the only living tobacco seedlings in the Parkridge district on the 8th November were those which had been sprayed with copper emulsion as described above.

SUMMARY.

Six fungicide experiments for the control of blue mould (*Peronospora tabacina*) of tobacco, which were carried out in the Brisbane district in 1932 and 1933 are discussed.

Tobacco seedlings are difficult to spray efficiently, owing to the fine tomentose covering of the leaves and to the low-lying habit of the young plants, which makes actual contact with the leaf surface difficult.

Hence in these experiments particular attention was given to the use of spreading agents, to fungicides in an extremely fine state of division, and to the manner in which the sprays were applied.

In preliminary trials which were carried out under normal field conditions, several sprays were found superior to dusts. Of the former copper emulsion was the most promising. "Agral No. 1," potash soft soap and molasses were found most suitable as spreading agents for Bordeaux mixture.

In further trials where seedlings were artificially inoculated and were grown under conditions very conducive to the development of blue mould, these results were substantiated.

The most suitable strengths, times of application, and manner of application were investigated.

It was found that home-made colloidal copper with soft soap as a spreader was most suitable as a fungicide for tobacco seedlings.

Copper emulsion was tested more thoroughly than colloidal copper in these experiments, and was also tried out commercially in the Brisbane district. It gave consistently rather satisfactory results, but requires considerable care in preparation.

Acknowledgments.

The author wishes to acknowledge the helpful co-operation of Messrs. J. H. Simmonds and R. B. Morwood, of this Department, in the planning and carrying out of these experiments, and of Mr. P. W. Moller, Manager of the Parkridge Tobacco Plantations Pty. Ltd., who made available seed-beds for experimental work.

Sample lots of many materials not yet on the market were made available free of charge by A.C.F. and Shirley's Fertilisers Ltd., and for these and many other courtesies the author wishes to express his sincere appreciation.

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Queensland Tobacco Soils.

By E. H. GURNEY and J. L. F. FORAN.

IT is only during comparatively recent years, owing to the increasing demand for lemon or bright flue-cured tobacco, that the industry, which previously was confined chiefly to the production of dark leaf, has taken on new life.

The incidence of this increased activity is due to the recognition of the fact that acres of land, heretofore looked upon as waste, owing to their poor sandy nature, were of the class that should produce -other factors being favourable—tobacco leaf of the desired commercial quality.

So far varying success has attended the efforts of various growers, and, although the amount of first-class leaf falls far short of requirements, still, the fact that in every district where tobacco has been grown, during some period of the last few years, bright leaf has been cropped has encouraged many of those in the industry to be optimistic in their continued efforts.

The many interdependent factors influencing the production of the desired leaf are outside the scope of this article, since it is devoted mainly to a description of the tobacco-growing areas of Queensland. Soils of other parts of Australia have already appeared in other publications (1·2) and it is thought desirable that those of this State should be so recorded.

Distribution of Tobacco Soils.

Tobacco soils in Queensland are widely distributed over the eastern coastal belt of the State in certain well-defined divisions. In the northern section are the red soils of the Laura district, with those of Mareeba and Chewko a little further south. To the latter have recently been added a good deal of hitherto unoccupied country around Dimbulah. Again good tobacco has been grown at Hervey's Range, where a fair amount of initial experimental work was previously carried out, and at Charters Towers.

In the Central district marketable leaf has been produced in the Bowen and Mackay (Sarina) districts. A little tobacco is being grown around Rockhampton—at Yeppoon—and further South the industry has been established at Miriam Vale and Bundaberg. At Stanthorpe and Inglewood and Texas in the south-eastern part of Queensland a certain amount of success has been achieved, whilst the latest addition —the Beerburrum Settlement—has contributed its first quota. Consequently it is seen that there is a very extensive range of districts, from tropical to warm temperate, where tobacco may be grown, and as a great deal depends on climatic influence, for the production of bright leaf it will be appreciated that an intelligent study of the soil may be the means of mitigating any undue influences due to extreme variations of such climate.

Description of Districts—General.

(In the following paragraphs Soils Nos. between 3215 and 3489 appeared in the Annual Report of the Department for 1931 and 1932. Numbers from 3489 to 3632 appear in the Annual Report for 1933).

Laura (Nos. 3408 and 3473)—In this, the most northerly district where tobacco is grown, samples representative of thousands of acres were taken on a superficial survey by departmental officers in 1931. They are typical of poor red and reddish-brown sandstone country. The surface soil is shallow and has a preponderance of coarse sand with an increase in clay content at a depth of two feet six inches, where it is of a deep red colour.

Chewko (Nos. 3215 and 3220)—These soils are in the parish of Tinaroo bounded by the Chillagoe Railway and Nicotine and Narcotic Creeks. The country generally is thickly timbered with gum, tea-tree, and ironwood forest, and is of granite formation. They are poor grey loose sandy soils with grey to greyish white subsoils. In places there are tea-tree swamp areas.

Mareeba (Nos. 3507-3514)—This district has been looked upon as typical for bright tobacco production. There are three types considered, all of which are granitically derived—(1) A grey fine sandy alluvial soil containing about 10 per cent. of silt; (2) a red sandy soil; and (3) a white sandy soil. The two latter are much coarser in texture than the former, whilst all three are fairly deep soils with similar subsoils.

Dimbulah (Nos. 3552-3565)—During the last couple of years, much of this area was thrown open for the purpose of selection by prospective tobacco growers, with the result that, at present, there are a fair number of lessees in occupation. The area is watered by Walsh River and its tributaries—Horse Creek and Eureka Creek. The soil is of the poor loose sandy class and is timbered with tea-tree and pandanus and quinine, the tea-tree undergrowth being dense in parts. At Horse Creek a light grey sandy soil overlies a greyish white subsoil. Facing the high creek bank the soil is deep. Portion of this area has a hard, somewhat indurated surface. On Eureka Creek the soils are coarse in texture, the subsoils being described as coarse and sandy but containing less gravel and more coarse sand. At Innot Hot Springs the soils are grey in colour and contain very little fine gravel, but are still coarse, the subsoil, of a light-brown colour, being very similar to the surface.

Hervey's Range (Nos. 3296-3297)—The soil at Hervey's Range belongs to elevated country surrounded by rocky ridges, and consists of a fairly coarse grey material with a higher content of silt and clay than those previously mentioned.

The Charters Towers soil and subsoil (No. 3532) is not so coarse and does not contain much of the finer fractions, whilst those of the Bowen district are chiefly coarse sands, one sample (No. 3298) containing 76 per cent. of coarse sand. This is very rugged country, thickly timbered with ironbark, wattle, and bloodwood, and the soils are of granite origin.

Mackay (Nos. 3286, 3287, 3289 to 3291)—About twenty miles south of Mackay in the Sarina district, close to Plane Creek tramway, similar to Chewko as regards their flora and derivation. Around Mount Chelona are brown and greyish brown soils on poor coarse sandy and gravelly ridges. Their subsoils are distinctive in being of a yellow coarse sand.

At Blue Mountain, which is much nearer the coast, the soils and subsoils are similar on the higher land to those of Mount Chelona. This higher ground shallows off on the Alligator Creek side, which consists of dense mangrove swamps.

Inglewood (Nos. 3469, 3470, 3487 to 3489).—Fair prices were obtained this year for tobacco from this district—sandy alluvial river flats, with coarser and sandier higher ground. The soil is formed of decomposed granite. The better-class leaf came from the higher area.

Stanthorpe (Nos. 3409, 3410, 3478).—The poorer grey sandy soils, exsting in this granite belt, have been devoted in instances to the cultivation of tobacco. They are of a finer texture in the vicinity of Amiens than at Stanthorpe.

Beerburrum.—The soils here quoted are from an experimental plot on virgin land and are of fine sandy to sandy texture.

Texas.—So far the sandy soils of the district have not been through the laboratory.

Chemical Analyses.

All samples of tobacco soils were subjected to chemical examination, and the results of some of these analyses have already appeared in the Annual Reports of the Department of Agriculture of 1931 and 1932, the balance being recorded this year. Although soils suitable for bright leaf tobacco are not considered from a chemical standpoint, as soils of low plant-food content are chosen for the production of bright leaf tobacco in order that the required kind and quantity of plant foods may be supplied by the application of fertilizers, still a few notes may be of interest. A study of the results show that the analyses are typical of poor sandy country. For a sandy soil to be said to contain a "fair" amount of humus, such humus content should at least be 1·5 per cent. On analysis average figures for soil dried at 100 deg. C. may be given as follows:

—	Humus.	Other Organic Matter and Combined with Water.
	Per cent.	Per cent.
Laura	·30	·84
Mareeba district	·57	1·17
Hervey's Range	1·21	2·01
Charters Towers	·81	1·28
Bowen	·94	1·97
Mackay	·79	·90
Miriam Vale	·64	1·35
Bundaberg	1·21	1·21
Inglewood	1·17	2·54
Stanthorpe	1·01	1·40
Beerburrum	1·28	2·42

Consequently, it is worth noting that all Queensland tobacco soils are deficient in this important constituent, with the exception, perhaps, of those individual soils at the Delta, Bowen (No. 3524), Inglewood (No. 3469), and Beerburrum (No. 3608). The latter is virgin land. Again, it is not desirable that the iron content be high. In the majority of cases the percentage of iron and alumina combined falls below 3 per cent., but at Bowen and Inglewood, in places, it reaches 10 per cent., whilst the highest recorded percentage was at Mount Chelona, in the Sarina district—19·0 per cent.

It should be sufficient to add that the amount of material insoluble in hydrochloric acid (sp. gr. 1·1) very seldom falls below 95 per cent. and in many cases reaches 98 per cent., an indication that the soils in question should be classified as straight-out sands, with the usual very low content of mineral plant foods.

Soil Reaction.

The hydrogen ion concentration of the soils was determined by the quinhydrone electrode (1:2 water suspension) except in a few of the earlier cases where the Truog test was applied.

Recourse had to be had to the antimony electrode for some soils fronting Walsh River and Eureka Creek (Nos. 3260-3263). All the soils in the Laura, Chewko, Mareeba, and Dimbulah areas were on the average slightly acid (pH 6·64: subsoil pH 6·46) with the exception of those at Innot Hot Springs, where they were more acid (pH 5·81). At Hervey's Range and in the Sarina district, the acidity is more pronounced (pH 5·3 to 5·5 both soil and subsoil). Beerburrum soils also fall in this region of acidity (pH 5·2). The Charters Towers soil has a pH 6.45 with subsoil similar. The soils of the Inglewood district are in the neutral range, while those of the Amiens district, according to the Truog test, were of medium acidity (equivalent to about pH 5·0 to 5·5) as against Stanthorpe (pH 6·6, subsoil pH 5·8).

Physical Properties.

Soil Colour.—The predominent colours of these sandy tobacco soils are grey and light brown, the subsoils being brown, white, and yellow, or principally combinations of these several colours.

Water Capacity.—The capacity for absorbing water is more pronounced in the lighter type of soils such as at Inglewood, the grey alluvial soils of Mareeba, Bowen (No. 3524), Hervey's Range, and Beerburrum. This is due in most cases to the higher content of humus. These soils are capable of absorbing as much water again as the coarser sandy soils, and about half as much again as the ordinary sandy soils. This is a matter of importance when rainfall may not be as regular as required for the growing crop.

Capillarity.—The capillary power for water of these soils is typical of all sandy soils, with the exception of a sample from Laura taken to a depth of 2 feet 6 inches. In this case the maximum capillary rise in the soil column was only 5½ inches, reached after three hours. No further increase in height was obtained; which may be attributable to the fine sand fraction containing particles, most of which approach the upper limit of the fine silt fraction. As it is the soil contains ten times as much clay as the sample from 1 foot depth.

Mechanical Analyses.

In a previous paragraph a general description of the Queensland tobacco soils has been given based on the analyses of all soils received at the laboratory for advice as to suitability for tobacco growing, and a reference quoted as to where the results of such analyses can be found. In the following table is present representative analyses of such soils

and subsoils on the International basis—i.e., coarse sand, fine sand, silt, and clay:—

Table of Mechanical Analyses of Soils.

Soil No.	District.	Classification.	Coarse Sand. 2·0—0·2 m.m.	Fine Sand. 0·2—0·02 m.m.	Silt. 0·02—0·002 m.m.	Clay. Less than ·002 m.m.	Graph.	Diagram.
			%	%	%	%		
3215	Chewko, Average 6	gr. c.s.s.	64·5	27·2	3·2	2·1	1	1
to 3220	Chewko, Subsoils	yl. br. c.s.s.	61·0	26·6	4·4	4·5	1	Similar to 1
3408	Laura, 0″–8″	br. f.s.s.	38·0	54·9	2·2	1·9	2	2
..	Laura, Subsoil	r. br. f.s.s.	39·5	42·9	3·1	2·0	2	Similar to 2
3473	Laura, 0″–30″	r. f.s.s.	31·0	52·2	4·1	11·7	2	3
3509	Mareeba	gr. f.s.s.	7·7	66·3	11·3	6·2	3	4
3510	Mareeba	gr. f.s.s.	14·0	68·0	10·5	5·5	3	5
3511	Mareeba	r. c.s.s.	67·0	24·0	3·3	2·2	3	Similar to 1
3514	Mareeba	wh. c.s.s.	59·0	35·0	2·8	2·2	3	..
3552	Dimbulah—Horse Creek	lt. gr. f.s.s.	33·5	58·0	2·0	5·0	4	6
..	Dimbulah—Horse Creek (subsoil)	br. wh. f.s.s.	31·4	57·6	5·5	4·0	4	7
3554	Dimbulah—Eureka Creek	gr. br. c.s.s.	76·9	15·3	2·8	2·0	4	8
..	Dimbulah—Eureka Creek (subsoil)	gr. br. c.s.s.	68·0	23·8	3·4	2·8	4	9
3556	Dimbulah—Innot Hot Springs	gr. c.s.s.	64·7	28·5	2·7	1·3	13	G
3562	Dimbulah—Eureka Creek	br. f.s.s.	37·2	52·2	6·5	3·3	13	H
3564	Dimbulah	y. br. f.s.s.	30·8	56·0	3·0	2·0	5	A
..	Dimbulah (subsoil)	y. br. f.s.s.	24·5	68·0	3·4	3·1	5	B
3530	Hervey's Range	gr. c.s.s.	67·0	17·5	8·8	6·2	6	C
3532	Charters Towers	lt. br. c.s.s.	62·0	24·5	7·4	4·1	6	D
3524	Bowen—The Delta	dk. f.s.s.	14·5	72·0	3·5	5·5	7	E
3526	Bowen—The Delta	br. f.s.s.	3·8	84·4	4·1	4·3	7	F
3531	Bowen	wh. s.s.	33·5	55·3	3·8	4·4	7	J
3319	Bowen—Mount Aberdeen	lt. br. s.s.	37·3	53·7	4·8	3·0	7	K
3289	Sarina—Blue Mountain	lt. br. f.s.s.	28·6	60·9	6·0	2·3	8	L
3290	Sarina—Blue Mountain	lt. gr. c.s.s.	52·7	34·1	7·1	3·9	8	M
3291	Sarina—Blue Mountain	gr. c.s.s.	54·4	37·9	5·4	2·3	8	Similar to M
3520	Sarina	gr. s.s.	44·8	49·2	1·0	3·0	9	N
3522	Sarina	lt. gr. s.s.	45·4	44·9	1·0	3·2	9	Similar to N
3569	Sarina	r. br. s.s.	42·0	49·2	3·5	2·5	15	O
3288	Miriam Vale	gr. br. c.s.s.	59·5	31·4	4·8	2·3	10	Similar to K
3542	Miriam Vale	br. f.s.s.	36·0	52·4	6·6	4·0	10	P
3566	Yeppoon—Byfield	gr. wh. f.s.s.	11·3	79·0	3·0	4·0	14	Q
3470	Inglewood	yl. br. f.s.l.	25·2	46·7	15·1	8·0	11	R
3488	Inglewood	lt. br. s.s.	42·0	46·0	5·8	4·2	11	Similar to H
3489	Inglewood	lt. br. f.s.l.	11·1	53·9	27·9	10·3	11	S
3478	Stanthorpe	lt. gr. c.s.s.	60·9	24·0	6·1	5·0	12	T
3409	Stanthorpe	gr. s.s.	39·9	46·4	5·2	3·0	12	U
3536	Parkridge	gr. br. s.s.	40·5	41·7	9·8	4·0	14	V
3538	Parkridge	bl. cl.	3·0	28·5	30·9	16·6	14	..
3411	Beerburrum	lt. br. c.s.s.	13·8	74·2	6·0	1·0	15	X
3608	Beerburrum	gr. s.s.	41·9	40·5	6·0	4·0	15	Y
		American Soils.						
N.C.	Cecil	s.l.	32·2	35·4	23·6	8·5	16	(1)
N.C.	Durham	c.s.l.	43·4	31·4	19·4	5·8	16	(2)
N.C.	Durham	s.l.	47·1	31·4	17·9	3·8	17	(3)
N.C.	Granville	c.s.l.	49·6	22·6	19·2	8·0	17	(4)
N.C.	Norfolk	c.s.l.	0·8	70·0	19·0	10·3	18	(5)
G.	Tifton	s.l.	16·3	62·8	12·0	8·2	18	(6)

These results were obtained after analysis by the British system from which they have been interpolated, by means of the graphs also shown. For purpose of comparison, the analyses of six typical soils from North Caroline and Georgia (America) where first-class bright leaf tobacco is grown, are also given. These latter are extracted from the pamphlet (No. 1) issued by the Australian Tobacco Investigation. It will be noticed that the American soils contain much more silt and clay than those of Queensland.

The following short table will make this clear—approximate percentages only:—

Soil.	Sands.	Silt and Clay.
	%	%
American	70 to 80	30 to 20
Queensland—		
Twenty-four soils	90	10
Six soils	85	15
One soil	75	25
One soil	65	35

The two latter soils, both from Inglewood, approach in mechanical composition, most closely to the American soils quoted.

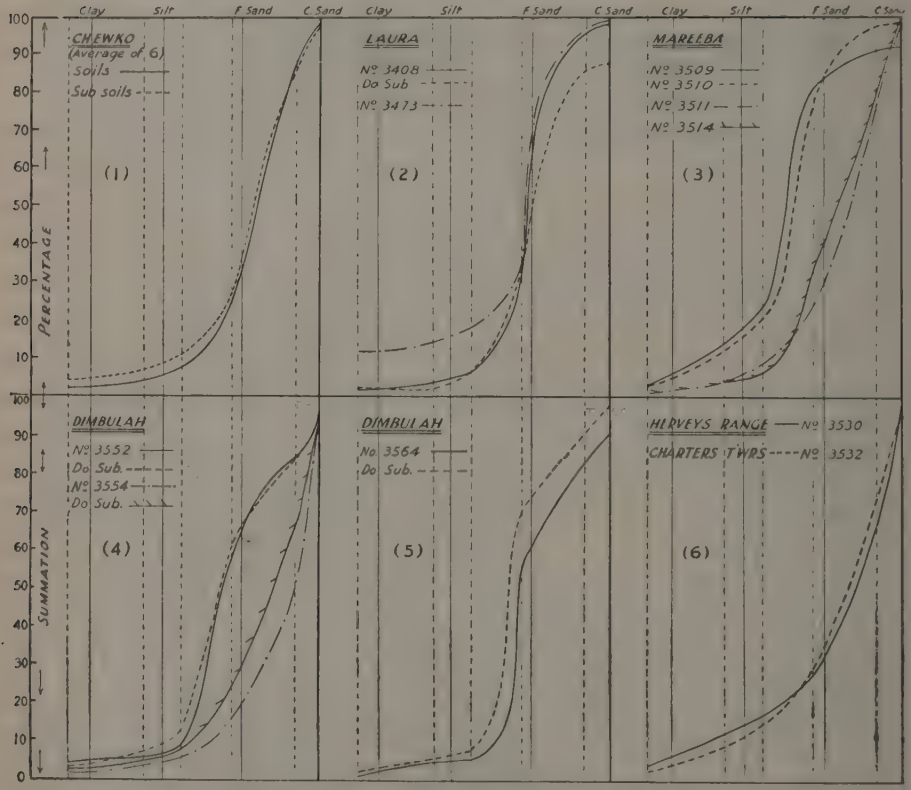

PLATE 132.—GRAPH I.

Graphs I., II., and III. illustrate the mechanical composition of Queensland tobacco soils. Dotted lines represent the limiting settling velocities of the fractions in the British system, and the continuous vertical lines represent the same velocities according to the international system.

Graphical Illustrations.

These soils are graphically illustrated and present a very striking picture. It will be noticed that the graphs of the American samples fall more to the left than most Queensland soils. A regular sweep of the curve indicates an even gradation of particles, from the largest to the smallest. There are many such regular curves illustrative of the Queensland soils. This even distribution of the soil particles is very important from a cultural point of view as, for instance, it would be the means of assisting in the even initial incorporation of applied fertilizer.

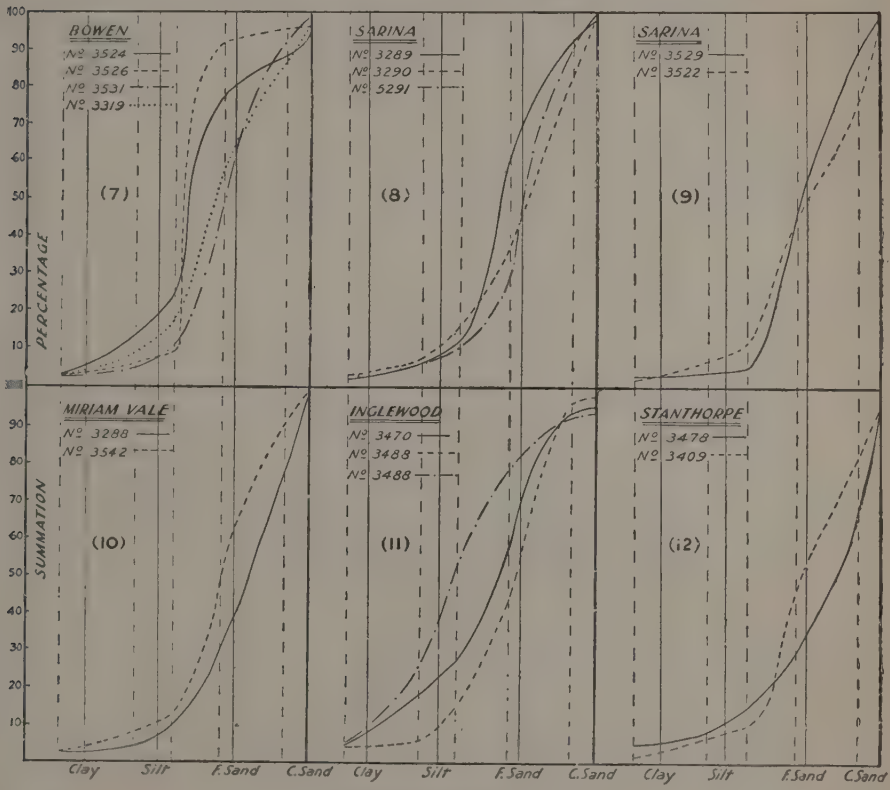

Plate 133.—Graph II.

Further, after interpolation and recalculation to 100 per cent., the mechanical analyses have been reduced to a point in the triangular diagram where it will be noticed that the Queensland soils fall in the section marked *sand*, whereas the typical American soils are in the *sandy loam* division, which comprises also only two Queensland soils, namely, those from Inglewood.

Conclusion.

Although these soils generally are sands deficient in mineral plant foods and humus, they contain inherent possibilities for the production of bright tobacco, and such possibilities have to be stimulated or nursed to obtain maximum results in the several districts, or, again, within the same district.

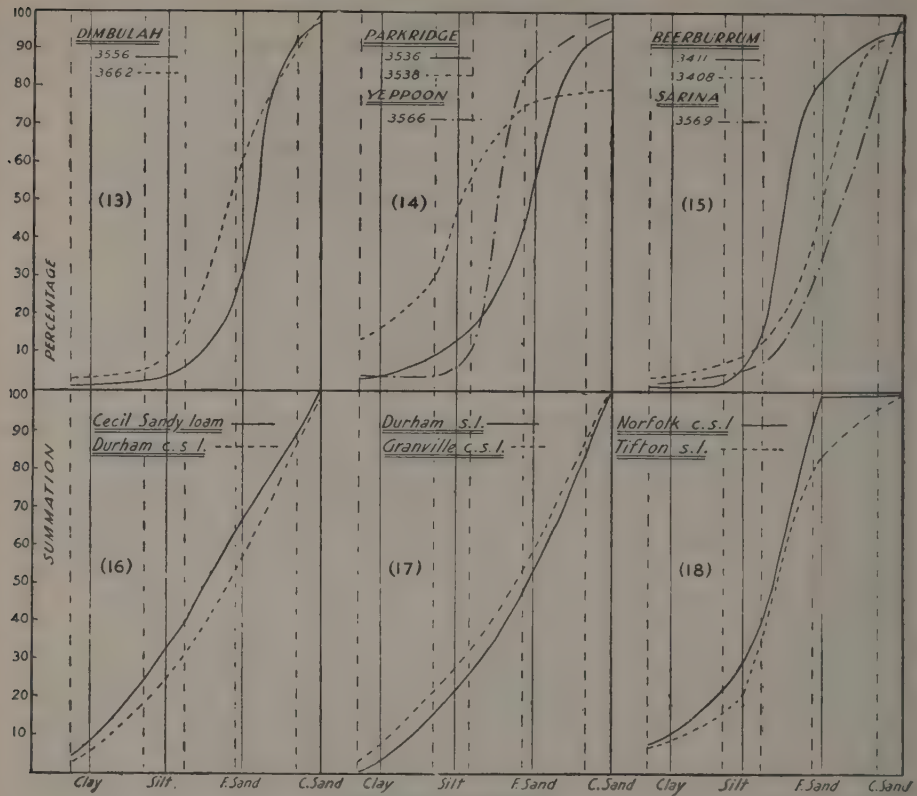

PLATE 134.—GRAPH III.

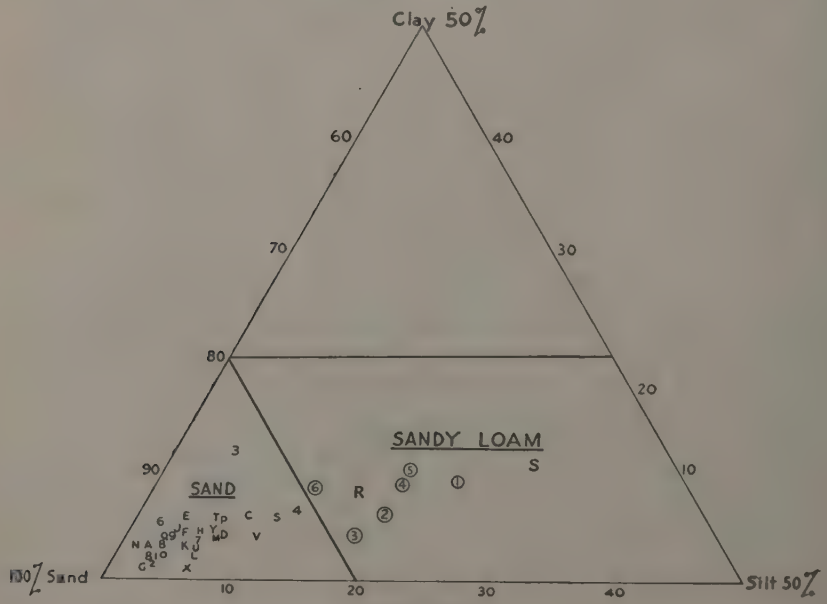

PLATE 135.

Patient co-operative effort on the part of the growers of each district in the collation of all local data, thorough and intelligent statistical analysis of such data bearing on all phases of the industry for correlation where possible with the class of leaf produced, should lead to the evolution of a quality leaf first and quantity afterwards in Queensland when the above information is combined with the knowledge of the variations in texture of the different soils.

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Australian Tobacco Investigation, Bull. No. 3.
2. Bainbridge, E. P., C.S.I.R., vol 1, No. 6, p. 350.
3. Robinson, G. W., Jour. Agr. Sci. (1924) 14, pp. 626-633.

THE JOURNAL IN PARLIAMENT.

In the course of the debate on Supply in the Legislative Assembly several appreciative references were made to the "Journal" and other departmental publications, and from which the subjoined extracts are taken from "Hansard" reports:—

"I desire to make reference to the good work carried out by the 'Queensland Agricultural Journal.' Unfortunately, this journal does not reach as many producers' homes as it should do. I suggest that a drive be made to popularise this very efficient and valuable journal . . . If these (subscription) forms were placed in the hands of members of local producers' associations, I feel certain more subscribers would be gained, and this very valuable journal would enter many more homes."—Mr. G. F. R. Nicklin (Murrumba).

"I congratulate the Department upon the issue of its very fine 'Agricultural Journal' which we receive from month to month. Its useful information is of interest to quite a large number of people. The majority of the producers know nothing about the 'Agricultural Journal.' That is their own fault. Every producer . . . is entitled to it, and can obtain it at the small cost of 1s. per annum. No literature can be cheaper. I desire to thank the Department for the 'Journal.' I get it and pass it on to those interested in dairying. They find it both interesting and important in their business."—Mr. Vivian H. Tozer, M.L.A. (Gympie).

"I would like to take this opportunity of thanking the Secretary for Agriculture and his officers for the many kindnesses I have received during the past year in connection with matters relating to my own electorate. I would also like to say that we farmers appreciate very much the monthly journal which is issued by the Department of Agriculture. Many farmers in my district appreciate the interesting matter contained in the 'Journal,' which is very helpful to them, and encourages them in the treatment of disease and other agricultural practice."—Mr. E. H. C. Clayton, M.L.A. (Wide Bay).

"'The Queensland Agricultural Journal' has been kept up to a high standard of efficiency. It gives full publicity to the various experiments conducted from time to time, and items of interest in connection with research work, also the work of our technologists. This is of great help to the farmer."—Mr. Harry F. Walker, M.L.A. (Cooroora).

Citrus Psorosis Control.

By L. F. MANDELSON, B.Sc. Agr., Assistant Plant Pathologist.

THE citrus disease known as psorosis is believed to have originated in the Orient and been disseminated with the introduction of citrus trees from the East to other parts of the world. The disease was first described in Florida in 1897, and since then has been recorded from most citrus-growing countries.

A suspected case of psorosis was first recorded in Queensland from Bondoola in 1927 by Mr. J. H. Simmonds, Plant Pathologist. Since then it has been reported from Yeppoon, Palmwoods, Mapleton, Montville, and Grantham.

Psorosis is a disease which develops very slowly, and it may be cured if treated before it has advanced too far. The following notes describe the symptoms by which it may be recognised, and they also discuss the most suitable method of treatment.

Symptoms.

As the outer layers of bark are first affected, the earliest symptoms of the disease are the formation of inconspicuous blisters and the scaling-off of small pieces of outer bark. The disease usually progresses very slowly, and an extension of the affected area with further loosening-off of the outer bark eventually occurs. Gum may exude from the bark of the affected tree to some extent, especially when the tree is growing actively. The exudation, however, is small, and not so conspicuous as in certain other bark diseases which are usually grouped under the name gummosis.

The trunk and main limbs, as well as small branches, may be affected, and as the disease progresses the affected area tends to girdle the limb or trunk. New bark has a thick, roughened appearance (Plate 136), is discoloured, and eventually breaks into scales or strips and sloughs off.

In time—probably after five years or more—the wood becomes seriously affected and decays. Consequently, in the final stages affected trees are stunted, the leaves produced are small and yellow, and the twigs die back. One or two limbs or the entire tree may in due course be killed.

Varietal Susceptibility.

Sweet orange (especially the Valencia orange), mandarin, and grapefruit are susceptible, whereas the sour orange and lemon are highly resistant.

Cause.

Owing to the very slow development of psorosis it has been found extremely difficult to demonstrate its cause. In some cases, investigators in America have produced the disease by inoculating healthy trees with pieces of diseased bark. At the present time the cause is still somewhat obscure, but it is considered that probably some very slow-growing organism is responsible.

Plate 136.—Citrus Psorosis.

Conditions Favouring the Development of the Disease.

The scaling process appears to be most active during summer and early autumn, which is probably due to the active growth of the healthy bark enabling it to readily slough off the dry bark scales above, at that time of the year.

When the bark is damaged through being knocked by implements or in any other manner it appears to be more susceptible to infection.

The age of the bark has a considerable influence on the development of psorosis, and incidentally has an important bearing on control methods. The disease is usually not observed on trees until they are eight or ten years old, and limbs are not attacked until the bark has been formed for four to six years or more. Hence young tissue apparently has a considerable degree of resistance to the development of psorosis. This fact forms the basis of the treatment, detailed below, which encourages the production of new bark.

Control.

The following procedure may be successfully employed for the control of psorosis, and may also be adopted for dealing with various bark diseases of citrus:—

Treatment is best carried out in the late spring or summer, and control measures must be adopted before psorosis has advanced too far, since such efforts are practically useless after the wood under the affected bark has become infected and discoloured.

Dead branches and branches which have been obviously weakened by the disease, as well as any scaling bark, should first be removed.

Treatment consists of scraping the outer bark of the affected area and beyond it, so as to eliminate the diseased tissue and to encourage the development of young, healthy tissue. A fungicidal wash is subsequently applied in order to dry out the remaining outer layers, to check the development of the disease, and also to protect the exposed tissue. It should be stressed, however, that the fungicide is merely supplementary to the scraping treatment, and that success depends upon the thoroughness with which the latter is performed.

Not only the visibly affected bark but also the apparently healthy bark for a distance of from 6 to 8 in. above and below the area and for 4 to 5 in. beyond the lateral margins of the affected area should be carefully and thoroughly scraped. The scraping should not go deeper than a third of the thickness of the bark. The outermost dark-coloured, corky tissue and most of the green layer immediately beneath it should be removed in this manner. The apparently healthy bark need not be scraped so deeply. When scraping, care should be taken to prevent the implement used jumping over gum-infiltrated areas, and cutting into the softer green bark.

Any large areas of bark which are dead to the wood should be cut out to the callus tissue which will have formed about the affected area. Smaller areas of hard bark or gum pockets need not be cut out, since they will slough off after the scraping treatment.

Various tools may be used for scraping purposes. The main essential is to have a sharp scraping edge, and to have a tool which can be used in depressions. A good, heavy knife or a box scraper is useful. The

latter consists of a reversible, triangular blade mounted in a handle. One or more of the corners of the blade may be ground off round for working in crotches and depressions. For this purpose and for light scraping, a farrier's knife with the end bent into a curve and retempered is a very useful implement.

After treatment, the scraped bark should immediately be painted with a fungicidal wash or paste. Several have been recommended for this purpose, but lime-sulphur and lime and sulphur compounds have been reported as being most effective in stimulating the bark-scaling process.

Either of the following formulæ may be used:—

1. Mix 1 gallon of concentrated lime-sulphur solution with 2 gallons of lime paste. The latter is prepared by slaking 3 lb. of quicklime in a gallon of water.
2. Slake a known weight of quicklime by adding a small quantity of water. While the lime is slaking sift slowly into it the same weight of flowers of sulphur, with constant stirring. Add only enough water to make a smooth, thin paste.

It will be found that within three to six months from the date of treatment, depending on the vigour of the tree, seasonal conditions, &c., the outer bark will crack loose and slough off. This loose bark may be rubbed off, and, if the treatment has been successful, new and healthy bark will then be exposed.

All trees which have been treated for bark diseases should be examined every few months for extensions of old diseased areas or for the development of new ones, and, if necessary, be promptly retreated. Frequently, especially with rather well advanced cases, two or three supplementary treatments may be necessary.

It must be stressed that the bark should be scraped well in advance of the obvious lesions; it should be scraped thoroughly and, finally, that subsequent treatment is frequently necessary for the successful treatment of bark diseases.

Since psorosis is comparatively new to Queensland, much of the information contained in this article has been derived from publications of the Florida Agricultural Experiment Station and from "Citrus Diseases and Their Control," by Fawcett and Lee.

Banana Thrips and the Problem of its Control.

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THE banana thrips, *Scirtothrips signipennis* Bagnall, is no new pest in the State of Queensland. The rust with which it is associated was known in North Queensland in the early days of the industry, though the relation between the disfigurement and the pest was not established until the first decade of the present century. At that time Queensland bananas met only a limited part of the requirements of the southern States, the balance being imported from overseas. The bulk of the local industry was then in Chinese hands. On this account, together with the fact that the resources of the Department of Agriculture and Stock for research work were then slight, no intensive study was made of a problem which at the time appeared to be of mere local interest and of no great financial importance. During recent years the position has been entirely changed. Legislative and fiscal provision has been made for the industry, and under its aegis production has increased to a point at which the whole of Australian requirements, other than those of Western Australia, can be met from plantations in the two eastern States, while the cultural activities are almost entirely in Australian hands. In Queensland the greater part of the production has been centred in the southern section of the State, mainly because of the proximity to the principal markets and the consequent reduction in the freight charges incurred in the disposal of the fruit. The advance of production in the South and the marketing advantages secured by growers there caused a decline in the Northern production from even its earlier moderate dimensions until it constitutes an almost negligible proportion of the Australian crop. Hence, although the main features of the pest and disease complex in the North were more or less understood, no particular attention was paid to them until the banana thrips, previously known as an exclusively northern pest, made its appearance in epidemic proportions in the Gympie district in 1924. This was the first record of the banana thrips as a serious pest in the South, though the nature of the outbreak was sufficient to indicate that the insect must have been present for some years prior to that time. Since then consistent observations have been made on the pest and minor recurrences of the trouble noted, though until the summer of 1931 nothing comparable with the 1924 outbreak occurred. These observations indicated that the pest had spread through most of the southern districts, and it is perhaps true to say that it exists in all productive areas, though in some instances the losses are negligible or non-existent.

The first Gympie outbreak proved so serious that steps were taken immediately to procure information on the life history of the pest with the ultimate object of formulating control measures. A. A. Girault took charge of the investigation, and his conclusions were published in 1925 as Bulletin No. 1 of the Division of Entomology and Plant Pathology. This work contains a very comprehensive statement of the bionomics of the pest. Preliminary experiments on the control of the banana thrips were recorded, but for some years suitable field material for the elaboration of the inquiry was not available in the southern part of the State.

In 1926 some development took place in the north, and a considerable number of growers planted commercial areas in various localities. During the first cropping year, the banana thrips caused heavy losses, and the study of control measures became a matter of some urgency. Froggatt initiated control experiments in 1927, and explained the possibilities of calcium cyanide dust. Since that time northern plantations have suffered to some extent each year, while the encroachment of the pest on previously clean areas in the south culminated in heavy losses during the summer of 1931-32.

With the establishment of an entomological field station at Cairns in 1928, it seemed desirable to study the control phase of the problem for two reasons. The first derived its emphasis from a probable development of the industry in the north—a development which for various reasons has not materialised. The second depended on the availability of experimental material in plantations near Cairns. This bulletin summarises the data to the present time, and discusses the problem from a number of different angles.

Thrips in Relation to Rust on Bananas.

The banana thrips belongs to a group of insects, the *Thysanoptera*, representative species of which are known to attack many cultivated crops, epidemics in some instances being quite common. It is natural, therefore, that the group should have been studied in some detail in most countries where agriculture is a permanent activity. The whole range of insecticides has consequently been exploited, and some conclusions were drawn which served as a basis for this work. Briefly, these indicated that only insecticides such as nicotine which kill by contact or others dependent on direct fumigation are of any material utility. Though insecticides were originally applied in spray form, there has during recent years been considerable development in the manufacture of dusts for the purpose, but in almost all cases the degree of control secured has been determined by the accessibility of the insects at the time of treatment. In the case of the banana thrips the problem is somewhat complicated by the conditions under which the host crop is grown. For the most part plantations are situated on steep slopes more or less removed from the adequate water supplies necessary for the convenient preparation and use of sprays. Hence, apart from a limited acreage grown on creek flats, sprays may be omitted from the available means of control and attention concentrated on dusts of some kind or other. In his preliminary work, Girault indicated that pyrethrum might be useful when used as a dust applied directly to the bunch. Froggatt later reported satisfactory results with calcium cyanide, a dust which liberates prussic acid when exposed to the air, but the possibility of injury to the fruit demonstrated in subsequent plantation practice led to its ultimate abandonment. Hence the present work touches other phases of the subject which have not so far been explored, while an attempt is made to bring the whole question into its proper setting as an integral part of the pest and disease problem in the banana plant.

The Nature of Banana Thrips Rust.

The essential nature of the rust phenomenon has been outlined by Girault and merely needs recapitulation here. The injury is caused by the superficial feeding of the insects on the surface of the fruit. In its early stages, this consists of mere surface erosion, but as the attack

may take place when the fruit is very young the injury may be out of all proportion to the numerical population on the bunch. At first there is a slight discolouration, which may or may not develop into rust—that particular type of discolouration from which the trouble derives its name. But the nature of the rust varies, being sometimes glossy red over the surface and sometimes ochraceous. In mild cases the injury is restricted to the contact surfaces* of the fingers and may be of no great consequence. It may, however, extend over the whole surface of the fruit without associated splitting of the rind. Sometimes the injured rind is incapable of adjusting itself to the physical demands made upon it during subsequent growth, and cracks, the depth of which vary with the severity of the injury, appear on the surface. Thus the damage associated with thrips shows all gradations from simple discolouration of the fingers at the contact surfaces, to discolouration over the whole surface plus more or less severe disruption of the rind. In North Queensland, fruits of the latter type are usually of a reddish colour, but this may not be general. It would appear that if for any reason bunches remain attached to the parent plant for any considerable length of time, an ochraceous colour is more usual. This is typical of those bunches, which, thrown in late summer, remain attached to the plant for some four or five months before being ready for cutting. Such bunches are common in the south of the State, where growth conditions are less favourable than in the north at any given period of the year. No matter what the colour, the appearance of the fruit is so affected that, even if marketable, its value is seriously depreciated.

When colour or rust first attracted attention in the southern markets, the cause of the blemish was quite unknown. The first suggested explanation came from New South Wales in 1903 when Cobb, handling marketed fruit showing the typical symptoms, claimed to have isolated a causal organism, but Tryon after familiarising himself with the field aspect of the trouble, concluded that the banana thrips was the primary cause. Later workers have all confirmed his observations. Cobb's earlier thesis is perhaps explicable when it is remembered that though thrips attack a number of cultivated plants, none show symptoms analogous to those associated with the banana. The uniqueness of these prompts a discussion of the phenomenon.

The anatomy of thrips mouthparts has been described by Peterson and others in an attempt to explain the mechanism of feeding within the group. Of the several species studied, no significant differences from the type form have been noted in the Terebrantian thrips, the distinctive point being the general absence of the bilateral symmetry which is usual in the oral appendages of the Insecta. Instead, one of the mandibles is almost vestigial while the other is modified to serve as a stylet moving within the cover of a cone formed by the upper and lower lips. These modifications have become associated with a type of feeding which combines a scraping with a sucking action, the fluid contents of the injured tissues being thus imbibed by the insect. With an injury of this type to the rind, it has been assumed that the phenomenon of rust in its several phases is the consequence of a natural callus over the wounded surface, the colour of which is modified by the peculiar properties of the exuding sap.

* "Contact surface" is a term frequently used in this paper to designate the apposed surfaces of adjacent fruits where the banana thrips tend to congregate. In current parlance the term implies proximity, but not necessarily actual contact.

The sap in some Musaceæ may at times possess a high tannin content. In the banana plant the concentration of tannin reaches its maximum in the bunch, being at its greatest intensity when the fruit is young and disappearing slowly as ripening takes place with the accompanying aggregation of sugars. Should the sap be removed from the bunch, discolouration takes place on exposure, and it is presumed that this discolouration of the extract is due to some derivative product from the original tannin content. One of the commonest tannin derivatives is phlobaphene, and its colour characters correspond to some extent with those of the exposed and congealed sap from the banana plant. If the rust characters are correctly attributable to phlobaphene, it ought to be practicable to induce at least something like rust by artificial means, and a series of trials were commenced with this end in view.

When sap is first liberated from cut tissues or injured surfaces, it flows as a translucent whitish fluid with a syrupy consistency which varies according to the part of the plant from which it is extracted, being most viscous in the region of the bunch stalk. This translucent appearance is quite transient, for the solution gradually congeals or drys out into a gel-like product, assuming a brownish colour which may not necessarily be evenly distributed through the matrix. Drops of such fluid may often be found on the fruit, either in the immediate vicinity of fruit fly punctures or on the uninjured surface contaminated by drippings when the fruit is being cut and packed for the market. Presumably these, as examples of sap exposed to the air, share some of its tannin content and the colour would then be due to derivative products resulting from exposure—phlobaphene in particular. The brownish colour which everywhere occurs in free sap is, however, distinct from the glossy red typical of rust. The thickness of the sap deposit makes no difference to the essential colour, for a reduction in the thickness of the fluid merely reduces the intensity of the colour, until it ceases to be evident. Hence it follows that sap exudation by itself is not sufficient to induce rust—at least on a smooth surface such as that offered by the rind of the fruit.

The methods adopted in the experimental attempt to produce the phenomenon of rust artificially were quite straightforward. Sample fruits were treated according to a given plan, the reaction within the next few hours being noted and the appearance a fortnight or three weeks later recorded. The essential data is detailed in Appendix I., and only a summary statement given here in the main text. In some instances the rind was merely pricked with a sharp pointed needle over a given area, the depth being adjusted from superficial pricking to fairly deep insertion. Linear scratchings were also used, again with the same variations. In a third series, the instrument used was an eye scalpel, which induces a different type of injury with a broad V groove. In all these three types of surface injury the rind was destroyed to a depth varying from superficial injury with the minimum sap exudation, to violent injury in which the rind was destroyed to a depth of one-sixteenth inch. A fourth series allowed for the treatment of the surface of the fruit with a rasp or sandpaper of varying degrees of coarseness. Fresh sap was applied to the injured surfaces of some fruits in each series either with or without the crushed body contents of a number of thrips. The experimental material in each individual treatment included fruits from bunches of different ages. In this miscellany, it was practicable to assess the reaction of the fruit to injuries of various types, some of which

should approximate to that actually caused by the insects themselves when living on the fruits. After pricking, the sap accumulated in globular masses at the point of injury, but with general surface destruction there was a greater tendency to run. The sap, congealed on a sandpapered surface, showed the same essential features as have been cited in connection with other types of injury, except that when present in globules it was less easily removed.

The colour appearances of the several calluses were by no means consistent. When the surface of the fruit was completely injured, an initial dark discolouration subsequently yielded an ochraceous callus with a uniform colour over the whole surface. In the case of linear lesions, however, the colour of the callus varied from an ochraceous shade on the inner edge to a reddish brown at the outside. Within this range of colour some phases were comparable to rust proper, and this might be taken to indicate that the phenomenon of rust depends on a precision of injury depth which can only be reproduced with the greatest difficulty by experimental means. This explanation may be correct, but further contingencies may be noted. These include the cumulative effects of slight injury on any given fruit surface over a long period of time, the possible subsidiary consequences of colony movement through exuding sap, and finally, the probable incorporation of fœcal products in the drying medium. The possibilities latent in the second and third contingencies are beyond the resources of the laboratory, and could only be partially studied by treating wounded surfaces with sap exudate to which the crushed bodies of thrips had been added. No signs of any influence from this treatment could be obtained.

From the data so far outlined, it has to be concluded that the phenomenon of rust so far eludes reproduction by artificial means. The various phases of the work do, however, indicate the probable nature and mode of development of rust. The colour is almost certainly due to a tannin derivative, phlobaphene, its intensity being the cumulative effect of the constant deposition and redeposition of sap on one area as injury from the pest becomes more severe. The ordinary exudation would be so slight as to be negligible, but even a slight exudation continued over a considerable part of the life of the fruit would give colour without a depth to a once fluid medium, and thus rust in one of its many forms. Prolonged erosion of the fruit surface by the thrips together with their continual movements over the injured tissues may induce the marked adhesion which is characteristic of rust, in contrast with simple sap deposition in the experimental material.

The banana thrips has very definite phototropic reactions which tend to keep the insect well within the cover of shade. Normally in a well developed banana bunch, such shade is provided over the whole surface of the fruit prior to the shedding of the bracts, but once these are cast off the insects are restricted to a pasturage at the contact surfaces of the fruits, the shelter of the vestigial flower at the tips, or the sheath covers of the pseudostem. In a perfectly thrown bunch it is possible to have the bulk of the fruit discoloured if the thrips infestation is sufficiently heavy during the three weeks after eversion. Normally, however, the rusting would be confined to the contact surfaces of the fruits where, of course, it may be quite severe, but in any plantation the perfectly thrown bunch is the exception rather than the rule, and all

kinds of variations from the ideal type may be found. This is in no way surprising, for bunch throwing and fruit development place a tremendous strain on the resources of the plant.

There may thus be bunches whose size has been determined in a period of more than ordinary vigour, but which are thrown when the vitality of the plant is at a low ebb through climatic and subsidiary pest causes. There may be others in which eversion has been normal, yet the subsequent development of the bunch slow. In any plantation in its second cut, all the permutations and combinations possible in a habitat where pests, climate, and plant vigour vary may be found registered in the quality of the fruit and the conformation of both fingers and hands. In an area free from the banana thrips these may be of little moment, for adjustments over the bunching period compensate for aberrations in any one stage. In Queensland, where the pest is generally distributed, these aberrations are of some importance, for they influence the activity of the pest, and irreparable damage may be effected in a very short time. Some of these abnormalities require special notice:—

(*a*) *Non-inversion of the Bunch.*—In some classes of soil frequently and in others occasionally, stools may be observed in which the bunch appears erect in the throat of the plant, the bracts having rotted *in situ* while the visible fruit possesses the dull green colour normal to the submature or mature fruit. The bunch when cut out may contain sufficient hands to permit its classification as a potential first class bunch, or it may be a mere pigmy specimen of only freakish interest. Though the original quality of the two bunches is so entirely different, the same causes have been operating in each case to produce the choking in the throat of the plant. The essential point is that at a critical stage in the development of the bunch, growth has been almost completely arrested. Later on growth may be resumed, but in the meantime the structure of the various parts of the plant associated with the bunch have become much less plastic, and instead of a simple resumption of growth a type of plant cretinism is observed in which the bunch stalk is twisted within the pseudostem in such a way that to even support a pendant bunch would be quite impossible. Hence efforts to induce pendancy by cutting open the throat of the plant invariably fail, the stalk breaking before the bunch achieves maturity.

(*b*) *Delayed Inversion.*—The aberrations included in this category are essentially of the same nature as the former, but less severe in their effects. Commercial fruit may be obtained from affected bunches, though some hands present abnormalities in the shape and contour of the fruit. In the case of non-inversion, doubling back of the bunch stalk within the main stem is the rule; in delayed inversion it is the exception. The phenomenon appears when the growth rate slows down considerably, and the interim between the appearance of the bud in the throat and the shedding of the bracts is proportionately lengthened. It may also be evident should growth cease for any reason during the pre-bract-shedding stage. The symptoms are distinct. Instead of hanging vertically, the bunch has more the appearance of being thrust from the stem in a downward direction at an angle to the parent plant. In all cases the fruit has an aged appearance even before the bracts covering the hands are shed. Compaction of the basal hands is usual, for, though growth has apparently been normal at the inception of inversion, the change has taken place before the basal hands have been properly extruded. A

certain amount of food material is then passing through to the bunch, and individual hands have to expand within the very definite limitations imposed by the boundary of the throat. All types of fruit then appear in conformity with these limitations—the natural line of the adjacent fingers may be disturbed and neighbours overlap, the contours of individual fruits may be altered, and bizarre forms induced at this stage may persist to some extent even when growth again becomes normal. One of the most important features is the slow separation of the fingers in bunches subjected to delayed inversion. Fruits naturally rectilinear in cross section when first exposed fill slowly with a consequent delay in the appearance of the rounded contour, which initiates the separation of the individual fingers, and consequently adjacent fruit surfaces are apposed for a much longer period than would otherwise be the case.

The causes of variability in growth vigour are much the same as those which have often been noted in other crops. Bananas are grown on several types of soil of variable fertility in regions of widely different rainfall, and with all degrees of plantation management or lack of management. Over most of Queensland, however, it may be assumed that during the winter and spring months, the perversions of type habits described above are accentuated, and bear an extraordinarily close relation to two factors in the environment—viz., precipitation and the capacity of the soil to retain moisture. Should the main summer rains fail in any part of the State, almost all plantations, unless very favourably situated, bunch abnormally, while it is doubtful if ever a year goes by in any plantation without some bunches showing these or fundamentally similar abnormalities. The dual factors, rainfall plus the moisture retaining capacity of the soil, explain the major part of the trouble when the phenomenon is widespread. Others, however, such as pathogen activity or physical inadequacy of the soil, may also play a part by reducing the efficiency of the available root system. The rapidity with which plants show signs of impoverishment when subjected to slight deviations from the bioclimatic norm may be due to a multiplicity of causes. Ordinarily, plants reaching the bunching stage or carrying a young bunch should yield on examination a host of white turgid roots penetrating the soil both laterally and vertically. Very few plantations possess such a perfect root system, and in its place the only surviving roots are found to radiate from the corm in close proximity to the surface of the soil. Under such conditions it is scarcely remarkable that even a passing dry spell of but short duration may produce striking and even disastrous effects out of all proportion to the apparent cause.

In thrips infested areas, the physical malformations due to variations in the growth vigour of the plant are not in themselves of major interest. It is the influence of such abnormalities on thrips habits and activity which merit special attention, and the chief of these concerns the provision of shade conditions within the bunch for a longer time than is usual or desirable. Before elaborating these implications, it may be as well to summarise the method of bunch infestation and the relation which it bears to rust.

In the plant prior to bunching, colonies may be located under the membranous sheaths which border the decaying bases of leaves now past their period of usefulness to the plant. Passing nearer to the throat of the plant, the numerical incidence of the colonies diminishes, and when they do occur the age of the associated larvæ and the numbers per colony indicate, as would be expected, later establishment. In the

upper reaches of the plant, however, colonies are non-existant and adults alone are found secluded in any cover which may be available in the throat, sometimes at the base of the last leaf to be unfurled, their exact position being determined by the state of unfurling at the time of examination. Even the furled leaves are infested, for a membranous fringe to the leaf margin is so apposed to the adjacent leaf surface that adult thrips can penetrate to the tip of the leaf just about to unfold without being exposed to the open for a moment. This is of some importance to the bunch about to be thrown, for just as the bud appears adults are already in the vicinity to initiate infestation when conditions are favourable. In the basal hand, there is a space at the side into which the adults at once make their way and then pass from hand to hand until the whole bunch is infested—before bract loosening has begun. Egg laying takes place in the fruit and development quickly follows. Thus, in the thrips-active months of the year, even a normally thrown bunch may be infested with colonies of young before the protecting bracts have been shed. The actual injury caused by the adults themselves is slight, and their main importance depends on the colonies, or rather aggregates of immature forms for which they are responsible. Until the bracts are shed, no artificial control is possible, and with normally thrown bunches the injury has not, as yet, reached serious dimensions by the time control measures can be applied.

With abnormally thrown bunches on the contrary, the crucial factor is the extended duration of the throwing period in which two phases of thrips activity require notice. The first of these concerns the numbers of adults actually penetrating the bunch prior to its complete extrusion from the throat of the plant. The tendency of the adults to pioneer the pest exploration of the upper parts of the plants has already been stressed, and the obvious corollary of this habit is that the longer the bud is intimately associated with the throat of the parent plant, the greater the initial adult population of the bunch. Field observations indicate that neither adults nor larvæ migrate along the stalk to the bunch unless compelled to do so by special conditions such as overcrowding. Thus under ordinary conditions, stalk protection of the most complete type makes no difference to the losses through rust on the fruit. It follows then that the increased incidence of rust associated with delayed inversion is due to the increased adult infestation of the bunch. An increase in the total initial adult population implies a greater capacity to reproduce and found new colonies in the several hands. There is inevitably an interval between the first penetration of the bunch, and complete infestation. At this time eggs are being laid—by the females aggregated in the basal hands, to which they have ready access and the greatest freedom of movement. The earliest hatched larvæ thus occur in the basal hands, and this is one, though by no means the only, reason for the observed phenomenon that rust on any bunch is always most acute there.

The second consequence of abnormalities of this type depends on the extension of the period in which the thrips have abundant shelter, shade being essential to colony stability. In all bunches there is a stage in which individual fingers are closely fitted together under conditions of complete shade. At this time there is nothing to restrain the movements of the insects, and they wander at will over the whole surface of the fruit, though most of the eggs are laid on, and most of the young restrict themselves to, the interfruit surfaces. Delayed inversion prolongs the period in which the insects are feeding on the whole fruit

surface at a time when the surface is particularly vulnerable to injury of any kind. The twofold consequences of delayed inversion are, therefore, an increased thrips population on the bunch and an extension of their available pasturage for a prolonged period, in which no control measures are practicable.

From this elaboration of the details of thrips activity in the early life of the bunch, the discussion of discrepancies between thrips infestation and the incidence of rust may be resumed. It is quite conceivable that two stools may be standing near one another in the plantation, carrying equivalent thrips populations, and yet showing a marked disparity in the loss due to rust. Almost any plantation will furnish examples. In some instances the conformation of the fruits in the mature bunch will indicate the explanation, while doubtful cases may be checked by tracing the development of the bunch from eversion to cutting. Even after the bracts are shed, the pasturage of the insects may remain extensive if the growth vigour of the plant is low, with consequent delay in the spacing of the fruits and change in their contour from the rectilinear to the rounded form.

EXPERIMENTAL WORK ON CONTROL.

Though the life history data on the banana thrips was fairly complete at the commencement of the experiments now under discussion, the control data was in a much less satisfactory position. Widely different opinions concerning the value of insecticides has been expressed by growers. Hence prior to initiating any further work, the affected areas in the north were visited with a view to sifting the available field information. Unfortunately, the opinions of interested growers yielded nothing but a chaotic mass of material which rarely agreed with the theoretical attributes of the insecticides concerned. Earlier official recommendations having proved somewhat disappointing in handling this extremely difficult problem, growers had for some years been using a variety of insecticides, claiming success for some of them. Most seemed to have no sound basis, but in view of the decided lack of authentic information the early phases of the work were restricted to field trials with a limited number of possibly useful insecticides, including some sprays. It was thus hoped that systematic observations during a northern summer would indicate the precise nature of the problem, and the fields worth special study.

Preliminary Experiment.

The plantation used was situated near Cairns at Edgehill on soil which, though perhaps not ideal from the cultural point of view, permitted the use of implements, thus offsetting to some extent certain natural disadvantages. The vigour of the plants was more or less the same over the whole area. The crop was approaching its second main cut, hence the bunches lacked any uniformity of development. Ideal material for experimental purposes is procurable only on a crop coming into its first cut, when the bulk of the bunches should be thrown during a six-week period. Difficulties inevitable when such a uniform series of bunches is not available are minimised to some extent by applying any individual treatment to bunches of different ages. Areas treated with any one insecticide contained both young and old bunches, and in none was either class unrepresented. Within any such group, the accumulated observations allow deductions as to the value of the spray or dust being investigated.

Some index of the vigour of the plants bearing the fruit to be treated is a necessary preliminary to assessing results. One may note the number of fruits per bunch, the size of the plant and so on, but in practice it is found that none of these individually or collectively give the information required. Better results have been secured by keeping a record of bunch development from the time of inversion to the time of cutting. The duration of this period varies throughout the year, but given two bunches thrown at the same time and requiring markedly different intervals for their development, the disparity will indicate the degree of difference in the experimental material, for idiosyncrasies in plant vigour from whatever cause are invariably reflected in idiosyncrasies in bunch development—differences of some moment so far as dusts and sprays are concerned. These variations from plant to plant may be due to a number of causes, root failure, nematodes, &c. Hence it is more than usually necessary to apply each individual treatment to a considerable range of plants.

The experimental scheme may be shortly summarised here. Three insecticides were introduced, lead arsenate, Black leaf 40, and Cloudform tobacco dust. Black leaf 40 and Cloudform tobacco dust possess, of course, the same toxic ingredient, nicotine, which in one form or other takes precedence in the control of allied pests in cultivated crops; hence no explanation of its introduction here is necessary. Lead arsenate, however, comes into a different category. The feeding habits of the banana thrips are such that toxic affects from a particulate poison which must be ingested by the insect would not be anticipated, yet claims have been made for the spray which at least warrant some inquiry. The treatments given were five in number, viz.:—

(*a*) Lead arsenate.—Rate, 3 lb. to 50 gallons water.

(*b*) Lead arsenate and casein spreader.—Rate as in (*a*), plus 1 lb. spreader.

(*c*) Lead arsenate and Black leaf 40.—Rate as in (*a*), plus 1 pint Black leaf 40.

(*d*) Black leaf 40 and soft soap.—Rate, 1 pint to 50 gallons water, plus soft soap.

(*e*) Cloudform tobacco dust.—2½ per cent. nicotine.

The area under experiment included 250 plants, 50 being assigned to each treatment. The thrips fauna at the inception of the work in March, 1929, was moderately heavy, though the amount of waste attributable to rust would not be considerable. The treatments were given at three-weekly intervals and repeated observations made before, between, and after each. Bunches in various stages of development occurred in each plot, and those just inverted were marked at the time of the initial treatment. The simplest method of marking consists in merely engraving the date on the bunch stalk—the subsequent callusing of the injury brings the date into sharp relief with the general green background of the stalk. There is no need to discuss the incidental problems raised by the mixing of the ingredients in the sprays. All the methods used are incorporated in general entomological practice and no new features were recorded.

The estimation of the value of individual sprays turns on the comparative amounts of rust observed on the fruit when the bunch is cut. With this criterion, it is possible to assert that none of the sprays

or dusts completely eliminated the rust phenomenon. A diminution of the amount of rust could, however, be detected in the bunches subjected to the lead arsenate-nicotine combination, the lead arsenate-spreader mixture and the tobacco dust. The improvement in the appearance and the value of the fruit was most marked on those bunches which received the initial spray or dust application immediately after the shedding of the bracts. Fruit treated with the tobacco dust was rust blemished only at the bases of the fingers, an improvement which would be anticipated were the thrips population materially reduced. In contrast with this, the two sprays of value containing lead arsenate restricted the rust to those parts of the fruit not carrying a spray deposit, the boundary of the deposit being also the boundary of rust incidence and presumably thrips activity. It is curious that lead arsenate used alone and Black leaf 40 used alone gave no apparent protection to the fruit.

In the several bunches from each plot, a considerable variation in rust incidence was obvious. Bunches semi-mature or further advanced at the time of the initial treatment showed no improvement, but others treated at an earlier stage in their development were cleaner than corresponding check bunches in the remainder of the plantation. Even in bunches of the same age, subjected to similar treatments, the rust incidence varied considerably, though such differences could usually be explained by reference to such disturbing factors as the conformation of the bunch and the relative efficacy of spraying as estimated by the particulate deposit left on the fruit surfaces.

From the results so far enumerated, some conclusions can be drawn. In the first place, none of the insecticides provide a complete solution of the problem; the data merely sheds light on the reaction of thrips to a number of insecticides applied periodically to the banana fruit. These contain either one or both of two toxic ingredients, lead arenate and nicotine, each of which may be discussed separately.

Lead arsenate alone gave no tangible control. In conjunction with either a casein spreader or nicotine sulphate, a limitation of the rust incidence was effected, particularly if the spray reached the fruit when the hands were first exposed. Such a result seems to clash with the usual conception of lead arsenate as an insecticide which must be ingested by the pest if any control is to be exercised by it. The determination of its real action in these trials thus seemed worthy of further investigation, and preliminary laboratory studies were therefore initiated.

Colonies of thrips were established on banana fruits, parts of which were treated with lead arsenate in both dust and spray forms. A series was arranged in which the appearance of the dust or spray deposits varied from visibility to below visibility, and colonies of thrips were established on the clean areas of the fruits.

The colonies included both adults and larvæ. No difficulty was found in establishing the insects on the fruits, and reproduction proceeded unabated for larvæ hatched from the fruits after a fortnight's enclosure. Rust appeared in the regions of colony formation. When the dust or spray cover was both visible and complete, the insects made no attempt to leave the clean parts of the fruit, and on these alone was rust ultimately found. The mortality rate was comparable in both treated and untreated fruits; hence it must be presumed that the toxic properties of lead arsenate have no influence on thrips habits, though

the insecticide does limit the range of their feeding sites. That the deposits showed some insecticidal value in these experiments cannot be gainsaid, but such a value must be inherent in the dust cover. It would thus appear that lead arsenate is insecticidal but non-toxic so far as the banana thrips is concerned.

This conclusion is confirmed by the distinct difference in the results with lead arsenate with and without spreader. In the latter the spray aggregates in globules of various dimensions over the surface of the fruit; in the former the globules are the exception, and in their place is an even deposit. It is the limits of this deposit which act as a barrier to the spread of the pest, and limit the rust affected surface of the fruit.

The influence of the nicotine on the lead arsenate is more difficult to assess, especially as the nicotine sulphate did not appreciably alter the rust position when applied alone. The worth of this insecticide depends very largely on the weather conditions at the time of its application. High temperatures prove most suitable, and it is just possible that the negligible results from the use of nicotine sulphate alone are attributable to unfavourable temperatures during spraying. The only other apparent cause would be a hypothetical influence of the nicotine sulphate on the surface tension of the lead arsenate—Black leaf 40 spray, whereby the deposit would be more evenly distributed than if the latter were omitted. Little is known about this phase of the subject, but there is some evidence to indicate that nicotine sulphate has some such property.

In the case of the spray and dust containing nicotine there is again a discrepancy in their respective efficacies which seems to suggest an influence from some factor other than the toxic constituent of the insecticide. The discrepancy may depend on differences in the accessibility of the fruit to dusts and sprays. Dusts would penetrate into crevices between the individual fruits from which fluids of any kind would be excluded and be less effective on that account. The balance of evidence in favour of the dust may again be attributable to its physical properties in much the same way as has been described in connection with lead arsenate. Hence a nicotine dust may thus be an insecticide which is both toxic to the insects and a hindrance to their free movement on the plant. Confirmation was sought by laboratory studies with a number of the dusts available. Experiments were commenced in which colonies of insects were subjected to several treatments, some of which had been previously used in the field. By this means, data was collected on colony behaviour over a period of some weeks. The essential procedure was as follows:—

The apparatus consisted of glass cylinders sufficiently large to hold a rust-free, submature fruit, but small enough to permit the examination of the thrips without the removal of the banana. Linen covers closed the ends of the tubes, the series being supported at an angle of 15 degrees by a wooden frame constructed for the purpose. At the lower end of each tube, damp but not wet soil served to increase the humidity and incidentally to accommodate pupating forms. By the artificial control of shade, each cylinder offered a range of light conditions varying from almost complete darkness at the base to complete exposure at the upper end. Hence as each fruit filled about three-quarters of the length of each tube, part lay in one environment and part in the other. When colonies were established on fruits not treated in any way, individuals introduced

at the upper lighted end of the container scattered immediately to the shaded parts of the fruit. Here the gradual aggregation of thrips led to the re-establishment of the loose colonies typical of the species. Supplies of thrips were procured from submature bunches of no commercial value, and the material included both adults and larvæ. The adults proved more suitable for experimental work than the larvæ, but the limited numbers of the former compelled the use of both forms. From the available range, some information on the reaction of specific stages to the various dusts was procured. Colonies contained from 50 to 100 individuals transferred from fruit to fruit by means of a camelhair brush, while the dusts were in all cases applied to a concentration of mass visibility.

The data from each case may be summarised as follows:—

I. Lead arsenate used without dilution.

(*a*) Area dusted.—Intermediate third of the fruit.

No insects crossed the barrier to the part of the fruit with the most favourable shade conditions.

(*b*) Area dusted.—The half of the fruit towards the base of the tube.

Barrier effective except where the dust had been removed from the angles of the fruit by contact with the glass.

II. A.P. No. 4.—Lead arsenate 10 per cent.; kaolin as carrier.

(*a*) Area dusted.—One half of the fruit towards the base of the tube.

Barrier effective where the cover was intact.

(*b*) Area dusted.—The whole fruit prior to the insertion of the colony.

Most thrips left the fruit shortly after arrangement, odd individuals persisting on parts cleaned by rubbing against the glass.

(*c*) Area dusted.—The whole fruit after establishment of the thrips colony.

Movements sluggish immediately, most insects leaving the fruit, but remaining active on the glass.

III. Cloudform tobacco dust.—Nicotine 2½ per cent.; hydrated lime as the carrier.

(*a*) Area dusted.—One-half of the fruit; this towards the base of the tube.

Most of the insects died within a short time of the arrangement, odd individuals persisting.

(*b*) Area dusted.—The whole fruit prior to the insertion of the colony.

Effect fatal.

(*c*) Area dusted.—The whole fruit after the establishment of the colony.

Effect fatal, presumably through fumigation.

IV. Kaolin.—The commonly used carrier in insecticidal dusts.

(*a*) Area dusted.—One-half of the fruit, this towards the base of the tube.

Barrier effective.

(*b*) Area dusted.—The whole fruit prior to the establishment of the colony.

Most adults and larvæ leave the fruit immediately; odd individuals persist on parts cleaned by rubbing against the glass.

(*c*) Area dusted.—The whole fruit after the establishment of the colony.

Movements sluggish, the insects leaving the fruit and wandering round on the glass.

Discussion.

In estimating the worth of any insecticide it is customary to ascribe the whole of its value to any toxic ingredient which it may possess. The above work indicates that this conception of things is not altogether correct. Three of the dusts used, lead arsenate, lead arsenate diluted to a concentration of 10 per cent. with kaolin, and kaolin alone yielded results with the banana thrips which are comparable in every way. With these three dusts, two are toxic, while the other is non-toxic in the sense that it does not possess any ingredient which is directly fatal to the insect. The only property which they all share is their particulate nature, and the behaviour of the insects on surfaces treated with the dusts suggests that any value which either or all may possess in the control of thrips depends essentially on this common property. Precisely what the effect of a dust cover on the fruit may be is difficult to estimate —it may be the obstacle it offers to free locomotion, or it may be the complications which it introduces into the feeding process. Whatever it may be, it has to be concluded that certain residues on the surface of the fruit hamper feeding and make colony establishment a difficult matter for the insect, and in the laboratory the range of feeding sites can be controlled at will by adjustments of a dust cover.

It would thus appear that inert dusts free from toxic ingredients may be of value in the control of the banana thrips while at least a knowledge of their real action must have a considerable bearing on the problem.

Inert Dusts in the Control of the Banana Thrips.

A number of entomologists have during recent years brought forward evidence to show that some inert dusts have decided insecticidal properties when used against certain pests. It would appear from their work that the value of these dusts is related to their physical properties, which restrict or prohibit the free movement of the pest. Thus the codling moth larva is said to be unable to effect an entry into the fruit if an inert dust cover is applied. A number of such dusts are already familiar in insecticidal work, not on account of their own specific worth, but as diluents for the toxic dusts in common use.

Only two dusts were available for the work, kaolin and talc, and a series of experiments similar in all essentials to those already outlined was initiated. Instead, however, of being content with such a term as

mass visibility, to indicate the concentration of the dust on the fruit surface, an attempt was made to determine the concentration which acts as an effective barrier to thrips movement, above which it is completely inhibited and below which colony establishment is possible. The counting of dust particles within a circumscribed area representative of the dusted fruit surface proved somewhat too difficult for ordinary convenience, and was therefore replaced by a series of microscopic colour contrasts. Limited areas on Bristol board coloured black with Indian ink were flecked with the point of a needle at even spacings to give a laboratory series of square centimetres containing from 50 to 400 white points, the series increasing by 25 points per square centimetre. Using constant optical outfit on the binocular microscope, an estimate of the dust concentration on the surface of the fruits could be secured by colour contrasts, in one case white granules of dust on a green background, in the other white intrusions of exposed Bristol board on a black background. Thus in any particular set of readings the magnified dusted surface of the fruit was compared with the unmagnified Bristol board series. The magnification being known, the particle numbers per given area of the fruit surface could be calculated, and thus the concentration estimated with some degree of accuracy. In determining the dust concentration of any fruit a number of readings were taken, the arithmetic mean being accepted as the desired statistic, at best a convenient approximation.

The essential data is set out in Appendix II., and only a brief summary of the results need be given here. Kaolin would appear to require a lower effective concentration of the dust to inhibit colony formation than does talc. The relative concentrations in terms of particles per square centimetre are 8,000 to 10,000 or in terms of mass cover 4 : 5. This simply means that heavier applications of talc would be necessary to procure the same results as those given by kaolin. Even when the concentration of the dust falls below the critical point—i.e., the concentration at which colony formation is inhibited—the movement of the insect over the surface of the fruit is hampered and there is some limitation in the amount of rust induced by the colony. On the other hand the conception of a term like "critical point" conveys little if the dimensions of the colony are not known, for the effective minimum concentration varies with the colony size and colony constitution. If the colonies are large and the available pasturage limited, the insects tend to encroach on the border line between the dusted and undusted parts of the fruit.

The nature of the grinding used in the preparation of these two dusts may also influence their measurable insecticidal properties. The talc used differed from the kaolin in two respects, for the particles of the former tend to be angular and lack the tendency to aggregate characteristic of kaolin. When insects wander over dusted surfaces they pick up fragments of the dust on their appendages, and the particle accumulation hampers their movements a great deal. This hampering is more pronounced in the case of kaolin than in that of talc.

In both dusts, the behaviour of thrips faced with dust concentrations just below the critical points was similar. The adults rapidly survey the surface in search of an area offering the optimum conditions for temporary establishment, but in the final equilibrium, both adults and larvæ occur together on dusted and clean areas of the fruit. Larvæ pick up dust particles much more readily than the adults, and are less

able to rid themselves of such impedimenta; hence it would appear that the adults would be the first to break across a diminishing dust barrier. Laboratory conditions suggest that if the dust cover does not altogether prevent larval movement, the immature forms ultimately locate the more sparsely covered areas on dusted surfaces and associate together in colony form. This is probably due to the fact that colony habits are essentially a larval trait.

An hour or so after the insects are introduced into the cylinder, reorganisation leads to colony formation. If the dust concentration is sufficiently high, the colony is finally located at the under surface of the fruit immediately adjacent to the margin of the dust. Numerous variations all explicable on the nature of the individual fruits distinguish the colony types. Thus some were scattered along the dust margins tapering away towards the apex of the fruit, while others congregated together in a dense mass. A third type occurred in which a subsidiary colony took up a position at the tip of the fruit in the shelter of the floral appendages, or in the corrugations common to these tips even when the appendages are removed.

In this series of experiments, a colony comprised some fifty insects, sufficient to cause rusting within a few days. At the higher concentration the dust barrier was effective, no insects crossing the line separating the dusted and undusted parts of the fruits. As the dust cover approached the critical point—i.e., the minimum concentration at which the larvæ can first encroach on dusted surfaces—the tendency to overstep the margin became more and more evident. The adults pioneer this movement and may leave the main colony, crossing the dusted surface to some point in contact with the glass container where friction has removed portion of the original dust cover. They there reproduce to establish a colony in some fourteen days' time.

In the case of kaolin, the larval critical point with colonies of some fifty individuals lies just below the level of mass visibility, but adults may cross somewhat more easily even at higher concentrations.

A series of fruit specimens with colonies of various sizes demonstrated that both the size of the colony and the units of which it is composed, make the estimate of an effective minimum cover a matter of some difficulty. Large colonies in confined spaces, by sheer pressure of numbers, interfere with the distinctness of the margin between dusted and undusted parts of the fruit, insects coming in contact with the dust carrying off particles every time they move. The progressive attenuation of the cover in this region ultimately allows an extension of the pasturage of the thrips. The phenomenon is particularly evident when the individuals in the colony are mainly mature larvæ and adults.

In all this work the rust developing under observation accurately reflected the observed pasturage of the insects in both location and intensity.

The series of talc material gave essentially similar results, though the dust does not appear to be so effective as kaolin. The difference depends on the nature of the dust, for kaolin more effectively hinders free locomotion than does talc.

The promising nature of these laboratory trials prompted further elaboration in the plantation. The initial field work was based on the assumption that effective treatment of the plant prior to the throwing

of the bunch should reduce the infestation at the time of inversion. Hence attention was focussed on a series of stools in the Edgehill plantation which were expected to bear their first bunches during January and February, the dust cover being arranged so that some of the plants received a superfluity of dust and others the minimum practicable covering—a deposit just visible to the naked eye. In all cases it would be above the effective minimum cover determined in the laboratory. The inert dusts were applied to the throat of the plant at weekly intervals both before and after bunching, yet in no case was any apparent limitation imposed on the thrips, at least, not such as would markedly diminish the amount of rust on the fruit.

The initial infestation of the bunch remained as high as ever, for the adults invade the growing point of the plant within the cover of the furled leaf, a fact which was realised subsequent to these trials. The maintenance of a continuous dust cover over the surface of the fruit in a North Queensland summer proved rather difficult. It is then almost impossible to get an even cover over the whole surface of the fruits with even the greatest care, and the frequent rains break down the protection once it is made.

It would seem to follow, therefore, that the ordinary inert dusts can have little utility in the control of thrips unless applied in some manner which improves their adhesion to the plant—e.g., in spray media. If means could be devised to procure such adhesion, there seems little doubt that the insecticidal properties of the dusts would be as marked in the field as they have been in the laboratory.

[TO BE CONTINUED.]

PUT CHILDREN ON THE LAND.

Because the return to prosperity will make a larger overseas market for Australian produce, the Archbishop of Brisbane (Dr. J. Duhig), speaking to a large gathering at Beaudesert recently, urged parents to settle their children on the land.

He added that the early commencement of a shipping service via Torres Straits would open up a great avenue for trade.

Speaking later at Canungra, the Archbishop said that he had been struck with the wonderful richness of the soil and great progress of the Canungra district. He considered the magnificent scenic grandeur of the adjacent National Park without peer in Australia. It was a great shame that this glorious mountain reserve, so handy to the metropolis, remained a closed book to 90 per cent. of the Brisbane people. If much of the relief labour which is being expended on chipping grass from the footpaths of Brisbane were employed in building roads to this great mountain resort, the results would be far more beneficial to the community, with increased tourist traffic. The Canungra Valley would easily support ten times its present population.

Mr. T. F. Plunkett, M.L.A., said he had first visited Canungra as a boy of 12 years, when it received one mail a week.

Breeds of Poultry.

By P. RUMBALL, Poultry Expert.

IT is impossible in the space of this article to deal with all breeds, and reference will only be made to those that are used to any extent in this State for commercial purposes.

Commercial poultry may definitely be grouped in three classes, viz.:—

Light Breeds.

Light breeds are usually breeds developed extensively for egg production with little or no attention being paid to table qualities. This class of bird may also be classed as a non-sitter. Among many strains individuals will be found in which the broody trait has not been bred out, but taken collectively they may be classed as non-sitters. Another character of the light breeds is that they are layers of white-shelled eggs.

Among this class Leghorns predominate, with probably the Ancona being the next most popular, followed by the Minorca.

Heavy or Dual Purpose Breeds.

Breeds of this class have been developed for table and egg-producing qualities. Taken as a group they are not as efficient egg producers as the light breeds, but individuals of this class hold the record as egg producers in this State, namely, 354 eggs in 365 days. Without exception all heavy breeds are very docile, whereas light breeds are of a more or less nervous disposition. Breeds of this class may also be referred to as sitters. Every effort is made to breed this characteristic out, and it has been done with some considerable extent by many breeders, but in the best of flocks broody hens will be found. The egg of this class should be brown in colour, although many pale eggs will be found in all breeds.

The most popular breed of this class is the Australorp. The Langshan is probably the next in favour, followed by the Wyandotte, Rhode Island Red, and Sussex.

Game Class.

This is essentially a table class. Although it may not prove profitable to breed Game fowls for table purposes, if it is found commercially sound to breed birds exclusively for the table the crossing of any dual-purpose fowl with the Game will add wonderfully to the table qualities of the progeny. This appears to the writer the most profitable manner to utilise the Game fowls.

Among the Game class is the Old English, Indian, and Australian Game.

STANDARDS.

In order to maintain breed characteristics it is essential to have standards to which to breed. Thousands of fowls are bred yearly by producers with little or no consideration being given to type. The departure from type may be attributed to some degree to the exaggerated specimens at times seen on the show bench, and to greater consideration being given by judges to feather markings than to types and egg-producing qualities.

From the one breed in many instances there has been developed two types, namely the standard-bred fowl and the utility-bred fowl. In trying to perfect his bird from a show point of view the fancier sacrificed egg qualities, while the egg producer in the race to produce eggs sacrificed type. The egg producer sacrificed type to such an extent that commercial breeders years ago drew up a utility poultry standard to be read in conjunction with the standard of perfection as laid down by the Poultry Club of England.

This move has proved of great advantage to the industry, insofar as the improvement in type that has taken place has materially assisted in mantaining the health and stamina of our flocks.

THE WHITE LEGHORN.

The Cock—General Characteristics.

Head.—Skull fine; beak stout, the point clear of the front of the comb; eyes prominent; comb, single, perfectly straight and erect, large, but not overgrown, deeply and evenly serrated, the spikes broad at their base, extending well beyond the back of the head and following,

Plate 137.—White Leghorns.

without touching, the line of the head, free from "thumb marks" and side spikes; face, smooth; earlobes well developed and rather pendant, equally matched in size and shape, smooth, open, and free from folds; wattles long and thin.

Neck.—Long, profusely covered with hackle feathers.

Body.—Wedge shaped, wide at shoulders and narrowing to the root of the tail; round and prominent breast; slightly rounded back sloping to the tail; large wings tightly carried and well clipped up; moderately full tail at an angle of 40 to 45 degrees from the line of the back.

Legs.—Moderately long; shanks fine and round; flat shins objectionable; and free from feathers.

Toes (four).—Long, straight, and well spread.

Carriage.—Sprightly and alert.

Weight.—Not less than 6 lb.

The Hen—General Characteristics.

With the exception of the comb (in the single-combed varieties falling gracefully over either side of the face) and the tail (carried closely and not at such a high angle) the general characteristics are similar to those of the cock, allowing for natural sexual differences.

Weight.—Not less than 4 lb.

Colour.—Beak, yellow or horn; eyes, red; comb, face, and wattles, bright red; earlobes, pure opaque white (resembling white kid) or cream, the former preferred; legs and feet, yellow or orange.

Plumage.—In white variety, white, free from straw tinge; principal varieties, white, brown, and black.

Scale of Points for White.—Head (comb, 12; lobes, 15), 27; colour, 25; type, 15; size, 15; condition, 10; legs, 8.

THE ANCONA.

The Cock—General Characteristics.

Head.—Skull moderately long, deep, and inclined to width; beak of medium length and moderate curve; eyes prominent; comb single, upright, of medium size, with deep serrations and five to seven spikes (broad at their base), the outline forming a regular convex curve, the back following the line of the head, free from "thumb marks" or side spikes; face smooth; earlobes inclined to almond shape, of medium size, and free from folds; wattles, long and fine.

Plate 138.—Anconas.

Neck.—Long, profusely covered with hackle.

Body.—Moderately long, with close and compact plumage; broad shoulders and narrow saddle; full, round breast carried upwards; large wings well tucked up; full tail carried well out.

Legs.—Moderately long, thighs well apart and almost hidden by the body feathering; shanks and feet free from feathers; toes (four) rather thin, well spread.

Carriage.—Upright, bold, and active.

Weight.—From 6 lb. to 7 lb.

The Hen—General Characteristics.

With the exception of the single comb, which falls with a single fold and partly hides one side of the face, the general characteristics are similar to those of the cock, allowing for the natural sexual differences.

Weight.—From 5 lb. to 6 lb.

Colour.—Beak yellow, shaded with black or horn, preferably not wholly yellow; eyes, orange-red with hazel pupil; comb, face, and wattles, bright red, the face free from white; earlobes, white; legs and feet, yellow, mottled with black.

Plumage.—Beetle-green with white tippings (the latter free from black or grey streaks). The more evenly V-tipped throughout with white the better, but tipped and not laced or splashed. Undercolour black. All feathers should be black to the roots, with beetle-green surface, and only the tips white.

Scale of Points.—Colour and markings (purity of white, quality of evenness of tipping, 20; beetle-green ground colour, dark to skin, 15; tail, 15), 50; head (comb, 10; eyes, 5; beak, 5; lobes, 5), 25; type, 10; legs, 5; condition, 5; size, 5.

THE MINORCA.

The Cock—General Characteristics.

Head.—Skull sufficiently long and broad to provide a substantial foundation for the comb. Beak stout, fairly long; eyes full, bright and expressive; comb single, medium size, perfectly straight, upright, and firm, not extending over the front of the beak, the back following without touching the line of the neck-hackle, nicely arched and evenly serrated with preferably five wedge-shaped spikes, free from "thumb marks" or side sprigs; face, smooth, the skin taut (wrinkles objectionable), as free as possible from feathers or hairs; earlobes almond shaped, medium size, of kid-glove texture, flat, and of firm substance, fitting closely to the head and not extending over the face, and without any tendency to hollowness, slackness, or roundness; wattles long, of oval shape, and fine texture.

Neck.—Long hackle, extending well down to body.

Body.—Broad shouldered, deep, square and compact, with a deep keel and straight breast bone; horizontal carriage; rather long back; full, round breast; medium length wings, carried closely to the sides and with broad flight feathers; fully furnished tail with long broad and nicely curved sickles, and carried well back.

Legs.—Of medium length, but without any tendency to stiltiness; shanks strong, but fine bone, free of feathers, straight and wide apart, no tendency to "knock-knees"; toes (four), long, fine, and well spread.

Carriage.—Upright, active, and alert.

Weight.—7 lb. to 8 lb. Cockerels, 6 lb. to 7½ lb.

Plate 139.—Black Minorcas.

The Hen—General Characteristics.

With the exception of the single comb (which is carried over one side so as not to obstruct the sight) the lobes, which should not exceed 1½ inches long and 1 inch wide, and the tail (neatly closed and carried well back), the general characteristics are similar to those of the cock, allowing for the natural sexual differences.

Weight.—6 lb. to 7 lb.; pullets, 5 lb. to 6 lb.

Colour.—Beak, dark horn; eyes, black or dark hazel; comb, face, and wattles, blood red; earlobes, perfectly white; legs and feet black or very dark slate, the latter in adult birds only.

Plumage.—Brilliant green-black.

Scale of Points.—Head (face, 15; comb, 15; lobes, 15), 45; colour plumage, 10; legs, eyes, and beak, 10), 20; type, 15; size, 10; condition, 5; breastbone, 5.

THE AUSTRALORP.

Queensland standard, as adopted by the Australorp Society, the National Utility Poultry Breeders' Association (Queensland Branch), and the United Poultry Club of Queensland.

Head.—Medium in size; skull fine with no fullness over the eyes; beak of medium length, strong and slightly curved; colour, black—5 points.

Eyes.—Full, prominent and expressive, dark brown iris, the darker the better—5 points.

Comb, Wattles, and Lobes.—Medium size, smooth and fine in texture; bright red in colour; comb erect, evenly serrated and following the curve of the head; wattles neatly rounded; lobes well developed—5 points.

Face.—Bright red, fine, not sunken, and as free from feathering and wrinkles as possible—5 points.

Neck.—Medium length; slightly curved and profusely feathered.

Body, Skin, and Abdomen.—Body deep, broad backed and of good length, breast of medium depth, broad and nicely rounded, keel straight and of moderate length, the whole giving a well-balanced appearance; wings well formed and carried close to body; skin, white, texture of finest quality. The abdomen to be elastic and full but avoiding indications of excessive fat or abdominal weakness—35 points.

PLATE 140.—AUSTRALORPS.

Tail.—Medium length, angle about 35 degrees in the male and 20 degrees in female—5 points.

Legs.—Medium length, strong and wide apart; shanks fine in bone and scale, free from feather or fluff; toes straight and well spread; legs and upper portion of feet slate to black; sole of feet white—5 points.

Plumage.—Soft, close, avoiding fluff and looseness; colour black, with green sheen—7 points.

Condition.—As indicated by general health, cleanliness of feathers and legs—10 points.

Carriage.—Erect and graceful—that of an active bird—10 points.

Weight.—Cockerel, 7 lb. to 8 lb.; cock, 8 lb. to 9 lb.; pullet, 5 lb. to 6 lb.; hen, 6 lb. to 7 lb.—5 points—Total, 100 points.

Disqualifications.—Side sprigs, any deformity.

Serious Defects.—White in lobes.

THE LANGSHAN.

The Cock—General Characteristics.

Head.—Skull, small and full over the eyes. Beak, fairly long, and slightly curved. Eyes large. Comb single, medium size, straight and upright, free from side sprigs, evenly serrated, with five or six spikes of even texture; earlobes, small and well-rounded. Face smooth, of fine texture, and free from feathers. Wattles of medium size and fine in texture.

Neck.—Of medium length with a full flowing hackle.

Body.—The back fairly broad, flat, of medium length, saddle abundantly furnished with hackles. Breast fairly deep and well-rounded from shoulder to shoulder, not flat; breast-bone straight, with keel level. Wings of medium length, closely carried.

Plate 141.—Australian Langshans.

Tail.—Of medium size, carried gradually up and outwards to an angle of about 35 degrees, and medium width, fairly close, furnished with plenty of tail coverts and two secondaries and two sickle feathers slightly longer.

Legs.—Thighs medium length covered with short soft feathers. Shanks of medium length, small boned, standing well apart and feathered down the outer sides (not too heavily or too scantily).

Feet.—Toes, four, straight, slender and well spread, the outer toe being feathered.

Carriage.—Graceful, neat, and extremely active.

Plumage.—Not too tight like the Game, not so loose as Cochin.

Weight.—Cock, 6½ to 8 lb.; cockerel, 5½ to 7 lb.

The Hen—General Characteristics.

With the exception of the fluff, which should be slightly more, the general characteristics are similar to those of the cock, allowing for the natural sexual differences.

Weight.—Hen, 5½ to 7 lb.; pullet, 4½ to 6 lb.

Colour.—Beak light to dark horn, not white. Eyes dark brown to hazel. Wattles and earlobes to be brilliant red. Legs and feet blue-black, showing pink between the scales, the web and bottom of the feet pink-white (the deeper the pink the better). Toe-nails white.

Plumage.—Dense black with a bottle-green gloss free from purple or blue tinge, medium texture.

Scale of Points.—Type, 15; colour, 15; head, 11; legs and feet, 11; condition, 11; skin (thin) flesh (white), 11; bone (fine), 11.

WHITE WYANDOTTE.

The Cock—General Characteristics.

Head.—Skull short and broad; beak short and well curved. Eyes large and bright. Comb rose, firmly and evenly set, low, square-fronted, gradually tapering towards the back and terminating in a well-defined spike (or leader) which should follow the curve of the neck without any upward tendency; the top of it oval and covered with small rounded points, the side outline being covex to conform to the shape of the skull. Wattles of medium length, fine and well-rounded.

Neck.—Of medium length, abundantly covered with hackle.

Plate 142.—White Wyandottes.

Body.—Short and deep, with well-rounded sides; broad round breast with straight keel; short back with full and broad saddle rising a concave sweep to the tail. Wings of medium size, well folded; tail well developed, spread at the base, the main feathers carried rather upright, the sickles of medium length.

Legs.—Of medium length. Thighs well covered with soft and webless feathers, the fluff full and abundant. Shanks strong, fine, well rounded, and free of feather or fluff. Toes (four), straight and well spread.

Carriage.—Graceful and well balanced, somewhat resembling the Brahma.

Weight.—Not less than 8 lb.

The Hen—General Characteristics.

The general characteristics are similar to those of the cock, allowing for the natural sexual differences.

Weight.—Not less than 6 lb.

Colour.—Beak, bright yellow (except Buff Laced, yellow or horn tipped with yellow; Columbian, yellow or horn; Gold Laced, Partridge, Silver Laced, and Silver Pencilled, horn shading into or tipped with yellow). Eyes bright bay. Comb, face, wattles, and earlobes, bright red. Legs and feet, bright yellow.

Plumage.—In white variety, pure white, free from yellow or straw tinge.

Principal Varieties.—White, Columbian, and Silver Laced.

Scale of Points.—The White: type, 25; colour, 25; size, 15; head, 15; legs, 10; condition, 10.

THE RHODE ISLAND RED.

The Cock—General Characteristics.

Head.—Skull strong, but not thick. Beak curved, moderately long. Eyes large and bright. Comb (single) medium size, upright, straight, and firmly set with five even serrations. Face smooth. Earlobes fine texture, well developed, and pendant. Wattles of medium size and moderately rounded.

Neck.—Of medium length and profusely covered with feathers flowing over the shoulders, but not too loosely carried.

Body.—Fairly deep, broad and long, but a distinct oblong rather than square; broad and full breast; long back, horizontal except where neck-hackle flows over the shoulders and the saddle gently rises; large wings well folded and the flights horizontal; fairly small tail, sickles passing a little beyond the main feathers well spread and carried somewhat low (but by no means drooping) to increase the apparent length of the bird.

Legs.—Of medium length; large thighs; well-rounded shanks, free of feathers. Toes (four) straight, strong and well spread.

Carriage.—Upright and graceful.

Weight.—8 lb.

The Hen—General Characteristics.

The general characteristics are similar to those of the cock, allowing for the natural sexual differences.

Weight.—6 lb.

Colour.—Beak, red-horn or yellow. Eyes, red. Comb, face, ear-lobes, and wattles, brilliant red. Legs and feet, yellow or red-horn. A line of red pigment down the sides of the shanks is desirable.

Plumage of Cock.—Hackle red, harmonising with back and breast. Wing: primaries, lower web black, upper red; secondaries, lower web red, upper black; flight coverts, black; bows and coverts, red. Tail (including sickles) black or green-black; coverts mainly black, but may be russet or red as they approach the saddle. Remainder, general surface rich brilliant red, except where black is specified, free from shafting, mealy appearance, or brassy effect; depth of colour (red) is slightly accentuated on wing bows and back, but the least contrast between these parts and the hackle or breast the better; an harmonious blending desirable. The bird should be of so brilliant a lustre as to have a glossed appearance. The undercolour and quills of the feathers should be red or salmon. With the saddle parted showing the undercolour at the base of the tail, the appearance should be red or salmon, not white or smoke. Black or white in the undercolour of any section is undesirable. Other things being equal, the specimen having the richest undercolour shall receive the award.

PLATE 143.—RHODE ISLAND REDS.

Plumage of Hen.—Hackle, red, the tips of the lower feathers having a black ticking but not a heavy lacing. Tail, black or green-black. Wings as in the cock. Remainder general surface lighter and more even than in the male, free from shafting or mealy appearance and except where black is specified, a rich even shade of bright red, not as brilliant a lustre as the male. The undercolour and quills of the feathers should

be red or salmon. Black or white in the undercolour of any section is undesirable. Other things being equal, the specimen having the richest undercolour shall receive the award.

Scale of Points.—Colour (plumage, &c., 25; eyes, 8), 33; type, 30; head, 10; size, 10; condition, 10; legs, 7.

THE LIGHT SUSSEX.

The Cock—General Characteristics.

Head.—Skull of medium size. Beak, short and well curved. Eyes, full and bright. Comb, single, of medium size, upright, evenly serrated, and fitting closely. Face smooth. Earlobes and wattles of medium size.

Neck.—Of medium length, with fairly full hackle.

Body.—Broad, deep, and long; square breast and carried well forward with long and deep breastbone; wide shoulders; broad and flat back. Wings carried closely. Tail of moderate size, carried at an angle of 45 degrees.

Legs.—Short and rather wide apart, the thighs stout, and the shanks strong and free from feathers. Toes (four) straight, long, and well spread.

Carriage.—Graceful and erect.

Plumage.—Close.

Weight.—9 lb.

Plate 144.—Light Sussex.

The Hen—General Characteristics.

The general characteristics are similar to those of the cock, allowing for the natural sexual differences.

Weight.—7 lb.

Colour.—Beak, white or horn. Eyes, red, except in Lights, orange, and in Browns, brown or red. Comb, face, wattles, and earlobes, red. Legs and feet, white. Flesh and skin, white.

Plumage.—The Light, pure white with black striped hackle, black in flights, and black tail, the black centre of each feather of the neck hackle to be entirely surrounded by a white margin, and finished in a decided white point, not a black tip or black outer edging.

Principal Varieties.—The Light, Red, and Speckled.

Scale of Points.—Type, 25; size, 20; colour, 20; legs and feet, 15; head, 10; condition, 10.

Utility Poultry Standard.

Type; colour (plumage and lobes); legs and feet (colour); condition—health, furnishing brightness and cleanliness of feather and legs; in accordance with the accepted standard of the breed.

Laying Characteristics, any Breed.

Conformation—

(*a*) Length, depth, width, proportionate to type of breed.

(*b*) Length as taken from base of the neck to base of the tail.

(*c*) Depth to be determined by the vertical space between the back and the breast-bone and the pelvic bones.

(*d*) Width as measured across the saddle and immediately behind the wings as is indicated by the distance apart of the legs.

Freedom from Coarseness—

(*a*) Shanks strong, as differentiated from either extreme coarseness of bone.

(*b*) Pelvic bones strong at base; long, fine, and straight.

(*c*) Tissue—pelvic bones to be free as possible from gristly covering.

Head.—Finely modelled; skull deep over eyes, full and round at back.

Eyes.—Full, bright, and expressive.

Face.—Bright, lean, free from feathering, and not sunken.

Comb and Wattles.—Neat, fine in texture, and medium size, avoiding "beefiness."

Neck.—Fine and fairly long.

Skin and Abdomen.—Texture of skin to be of the thinnest and finest quality and pliable; abdomen to be elastic, avoiding sagging-in, or fullness indicating excess of fat.

Plumage.—Feathers soft and silky, close, but not hard as in game; fluff moderate.

Weights.—Light breeds, ½ lb. to 1 lb. above minimum, and heavy breeds 1 lb. to 1½ lb. above two score maximum points; if in excess to be cut correspondingly.

Minimum Weights.

Light Breeds.

Leghorns, Minorca, Andalusians, Spanish, Campines, Buttercups, Anconas: cockerel, 5 lb.; pullet, 4 lb.

Hamburg: cockerel, 4 lb.; pullet, 3 lb.

Heavy Breeds.

Orpington, Plymouth Rock, Rhode Island Red, Sussex: cockerel, 7 lb.; pullet, 5 lb.

Langshans, Wyandottes: cockerel, 6 lb.; pullet, 4½ lb.

Any other variety: cockerel, 7 lb.; pullet, 5 lb.

Scale of Points.

Standard Points.—Type, maximum points, 20; colour (plumage and lobes, 7); legs and feet (colour), 3; condition, 5.

Laying Characteristics.—Conformation (indicating stamina and capacity), maximum points, 20; freedom from coarseness, 5; head, 7; eyes, 7; face, 6; comb and wattles, 5; skin and abdomen, 5; plumage, 5; weight, 5; total, 100.

Disqualification.—Under weight, wrytail, any indications of impurity of breed, dubbing, and faking.

ECONOMY IN POULTRY FEEDING.

On some farms a good deal of wastage of food occurs through faulty feed hoppers in cases where dry feed is given, while in other instances the over-feeding of wet mash results in much wastage. These are directions in which a little care would result in a saving without affecting egg production.

One of the common faults with the dry-feed hoppers is that they permit of the food being easily scratched out. A suitable type of hopper is illustrated in the department's free leaflet on the feeding of poultry. Where wet mash is used it is important that it be mixed to a consistency that will be neither too flaky nor too wet. If too much bran is used the mash will not hold together and can easily be scratched about the pen by the birds, and when this occurs it soon becomes dried up and is not eaten.

Another reason why on many farms the mash is fed in a very flaky condition is because the ingredients are mixed together before wetting them, instead of scalding the bran first and then mixing in the pollard. This latter method results in a far more satisfactory and appetising mash. For the adult birds the mash should be wet enough to adhere together under pressure with the hands, yet should not be sticky and should break apart when dropped into the feed troughs.

The quantity to be given will vary according to the rate of production and the weather, but the birds should have as much as they will consume within an hour without leaving any of the food scattered about. It will usually be found that what is not eaten in that time will be scratched about the pens and much of it wasted. Apart from that aspect, if given too much feed the birds become surfeited with food and production suffers.—A. and P. Notes, New South Wales Department of Agriculture.

THE EXPORT OF PORK PRODUCTS.

By Mr. E. J. SHELTON, Senior Instructor in Pig Raising.*

REVIEWING the export of pork products from Australia, and from Queensland in particular, it is of interest to note that considerable attention has been given recently to the development of overseas outlets for Queensland's pig products, and appreciable numbers of pork carcasses have found ready sale on the markets of the Old World at rates that have proved acceptable, although on a much lower range than is normal or desirable on both markets.

Our exports, however, are small in comparison with the exports of older countries, and statistics cannot be used to much advantage in a general discussion of this important subject, especially if an attempt is made to draw comparisons to emphasise the importance of this industry.

For the two-year period 1931-32, a total of 162,160 pork carcasses (inclusive of porkers and baconers) were despatched from Australia to the United Kingdom, Queensland's share of these exports being 105,250 carcasses, by far the largest number consigned from any State in the Commonwealth.

In 1932, owing to shortage of supplies here and to the low range of prices offering overseas, our exports eased off considerably; although trade interests still maintain their position on the markets referred to and indications are that the future will see a very appreciable advance in these exports, especially if prices improve in Great Britain and trade can be effectively organised and maintained.

Queensland pig-raisers will be interested to know that there appears to be an assured market for a substantial increase in shipments of frozen pork, and with the co-operation of the Queensland Meat Industry Board and other exporting firms the future of this trade is bright.

Experiments in the shipment of beef in a chilled (not frozen) form are now engaging the attention of specialists of the Council for Scientific and Industrial Research, and there would appear to be good reason for believing that in the future some progress along similar lines may be made with pork.

Unfortunately, for the past few months prices for pig products in the United Kingdom have been much lower than usual, but with the approach of winter there the price position has improved and is reflected in a slightly higher value here for porkers than baconers.

The most popular trade weights for export porkers and for heavier pigs to be manufactured into bacon in the United Kingdom are as follows:—

Export porkers, prime-quality pigs 60 to 100 lb. dressed weight, with a decided preference for pigs from 60 to 80 lb. dressed.

Export baconers, good-quality stock from 100 to 140 lb. dressed, with a preference for pigs slightly above the average for local trade in this State.

The export of heavier weight carcasses should also be of distinct value to producers here, for with abundant supplies of wheat, barley, maize, dairy by-products, and concentrates (including meat meal), that impetus to increased production so desirable would be provided.

It is satisfactory to note the steadily improving value of Australian pork and bacon pigs in Great Britain and to know that we can now average a higher price than is obtained for similar carcasses from New Zealand, one of our keenest competitors. It has been noted by the Queensland Meat Industry Board that with many pigs treated at the abattoir, there is room for improvement in type or finish or in both. Producers should, therefore, whole-heartedly embrace the opportunity offered by the Pig Improvement (Better Boar) Scheme of the Department of Agriculture and Stock to improve the quality of their pigs by the introduction of boars of white skinned breeds (Large White and Middle Whites); and by giving the pigs better care and attention, particularly at the critical stages in their development—viz., birth, weaning, and marketing.

The next step is organisation of supplies and placing of the export trade on a definite basis of expansion, so as to ensure continuity of supply and extension of overseas outlets.

* In a radio lecturette from 4QG.

PLATE 145.

Size with refinement is shown by this Large White sow, which won a championship at Brisbane Exhibition 1933. She is Pine Terrace Iris and was imported from New Zealand by the Kingston Pig Farm Company in 1930. Her length and leanness indicate typical bacon characteristics.

PLATE 146.

This typical Middle White sow was a prize winner at Australian shows. She carries that fleshiness and compactness so necessary for the production of well finished light-weight porkers.

Markets in the East.

It has not yet been possible to extend trade in the East beyond an ordinary average for the period through which we are passing, but with increased supplies of suitable stock available there is no reason why this trade should not grow. Stabilisation of price and orderly marketing are very necessary, and it is possible that at no very distant date a definite scheme along these lines will be placed before those concerned in this and the other States.

Speaking of organisation, it is well to remember that in developing market outlets for the products of the farm five distinct sections of the community have to be taken into consideration—the producer, the wholesale buyer, the retailer, the exporter, and the consumer.

The producer naturally looks to buyers and consumers for market outlets for the stock he has available, and it is but natural that both these sections of the trade should have some say in the type, quality, and weight of the pigs required. As it happens, there has been a definite change-over throughout the world from the heavier fatty type of animal so popular years ago to a carcass of more modest proportions. There is now no demand at all for heavy, fat meat of any description. Consumers the world over demand lightweight, fleshy, attractive, and appetising meat at a reasonable price, and at an early age so far as the animal is concerned.

This means that, where the change has not been effected on the farm, it is essential that the producer should become fully conversant with trade requirements and should so arrange methods of production to be able to cater for present day demands. Generally speaking, in the absence of consumer demand the buyer is not so much concerned with detail, buyers generally have little or no time for technical detail, claiming that it is the business of the producer to market his stock exactly in accordance with trade demands.

The exporter must, of necessity, be more attentive to detail than the local distributor, for competition in the markets of the Old World is even keener than it is on local markets; moreover, buyers in the Old World have supplies offering from many different countries. They can pick and choose as they feel inclined, and can well afford to refuse trade with producers who will not cater for their exacting demands. Retailers generally aim at satisfying the requirements of their customers and, in this connection, exporters of pork products have to satisfy a very exacting demand from retailers overseas where the consuming public is much more numerous and where there is a very wide choice. Producers here would, therefore, be well advised to co-operate whole-heartedly with departmental authorities and with exporters in organising the export trade and in emphasising the importance of export outlets.

PLATE 147.

A long-bodied fleshy pig of export bacon type. Note even development and absence of flabbiness which is general in pigs carrying a lot of Large White breeding.

Apart from colour (and in this there certainly is a decided preference for a white skinned export porker) there are other features that should be regarded as essential in building up an export trade. The type of pig required must receive first consideration. The long-bodied fleshy pig from whose carcass a maximum of nutritious pork chops can be secured is the one in most popular demand; the long-bodied, clean, well-debaired white finished carcass secures maximum in a scale of points. The pig must be neat and attractive with fine, comparatively short legs, and well-rounded hams covered with a minimum of fat. The hams in a porker are not quite as important as in a baconer, for they are sold in a fresh and not in a cured form. The loins need to be lengthy with a large proportion of flesh, and only a reasonable covering of fat. The sides and belly should be deep and well streaked with lean, while carrying a reasonable proportion of fat. As with pigs for other sections of the trade the head, neck, and shoulder should be as light as possible, as the forequarter, generally, is the cheapest portion of the body from a retailer's point of view.

The ideal porker is one that not only fills this specification, but one that is produced in a minimum of time with the least waste possible and at the lowest cost of production. The carcass must be free of bruises and blemishes, such as those caused by improper fire branding. With regard to the questions of breed, one feels perfectly safe in discussing such types as the Middle White, the Berkshire and their crosses, and crosses with a fleshy type like the Tamworth and the Large White particularly, for the heavier type of porker.

For export baconers, it is probable that the Large White and its crosses with the Middle White, the Berkshire and the Tamworth, will be much sought after, while the Tamworth-Berkshire cross for local trade requirements still holds a very important place and continues to prove acceptable on the overseas markets.

Plate 148.

Ideal light-weight porkers for export. These pigs, which were exhibited by the Dinmore Stud Piggery, won first prizes in the live and dressed forms in the Toowoomba Show pork carcasses contest 1933. Their breeding is Middle White x Berkshire.

Of other breeds still in the experiment stage in this State, one might refer to the Wessex Saddleback as a British breed with a good reputation overseas.

One must not forget that there is truth in the old saying that half the breeding is in the feeding and in the care and management of the pigs before and after their birth, for the very best of breeds can be absolutely ruined by improper feeding and handling.

We need also to consider the value of co-operative effort in the handling of supplies, for much needless expense may be incurred by the transport of railway wagons only partly filled with market stock.

The inspection of carcasses for the overseas trade is very strict, and many otherwise suitable carcasses are rejected because of being disfigured by large and unsightly fire brands.

Here is emphasised the very great advantage of the system of identification referred to as body-tattooing, a new system that promises to take the place of fire branding, paint marking, or other methods of identifying stock.

Let me add, in conclusion, that the Department of Agriculture and Stock stands prepared to co-operate whole-heartedly with every section of the community in the development of primary and secondary industries, and in the production of stock suitable for export trade.

The Better Boar Subsidy Scheme offers one form of financial assistance in the purchase of approved sires; the educational activities of the Department pave the way for the farmer to gain all the information required to enable him to market the correct type of stock, while the various organisations with which the Department co-operates are actively engaged in building up market outlets, and assuring for the producer a market for his stock at rates that compare more than favourably with those obtained in other countries for a similar class of stock.

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NEW HIGHWAYS IN QUEENSLAND.
THE WORK OF THE MAIN ROADS COMMISSION.

The Twelfth Annual Report of the Commissioner of Main Roads, Mr. J. R. Kemp, commends itself strongly to all concerned with the progress of country life in Queensland. This survey of a year's achievements leaves the impression that the Main Roads Commission is one of the most important factors in our rural development. It is a record of well-organised work, and, through the courtesy of the Commission, we are able to reproduce a series of excellent illustrations of that work, and which indicate the immense value of a great community service.—Editor.

THE history of roadmaking is the history of civilisation. The march of progress would have been impossible without the broad highway linking farm with hamlet, hamlet with village, village with town, town with city, and city with the countries of the world. Our literature is enriched with references to the road, convenient metaphors expressing human action and progress, and even stressing moral values. Thus we have "the straight and narrow path," "the beaten track," "the accustomed way," "the sunshine route," "the wandering trails," and the "broad road that leadeth to perdition."

Writing on this theme, Hilaire Belloc observes that 'the road is one of the great fundamental institutions of mankind . . . Not only is the road one of the great human institutions because it is fundamental to human existence, but also because its varied effect appears in every department of the State. It is the road which determines the sites of many cities, and the growth and nourishment of all. It is the road which controls the development of strategies and fixes the sites of battles. It is the road that gives its framework to all economic development. It is the road which is the channel of all trade, and what is more important, all ideas. In its most humble function it is a necessary guide without which progress from place to place would be a ceaseless experiment; it is a sustenance without which organised society would be impossible; thus, and with those other characteristics I have mentioned, the road moves and controls all history."

As a factor in the building of our own rural civilisation the importance of the work of the Main Roads Commission is widely recognised, and its annual report, from which the following extracts are taken, contains much of interest for all concerned with the development of a richer country life in Queensland.

DEVELOPMENTAL WORKS.

During the year considerable progress has been made in extensive developmental undertakings which have been initiated, especially in the North. Some of the more important projects are briefly described hereunder:—

The Palmerston Area.

In order that that portion of the Palmerston area (North Queensland) lying between the Beatrice River and the "K" Tree should be opened as early as possible, a grant of £10,000 was made available to the Commission. The construction of the road leading from the McHugh Bridge over the Beatrice River has been expedited, and provision has been made for metalling in order to allow more economical transport of the timber from this area which the Forestry Department will log out prior to dairying settlement.

The main road has been so designed as to provide direct access to approximately 75 per cent. of the blocks, thus greatly minimising the amount of pioneer access roads to be built by the Lands Department. The completion of this work should mark a new era in tropical land settlement, the main road being first constructed with the design of blocks based thereon. Some 10,000 acres will thus be made available in this area.

The opening of the McHugh Bridge by the Minister for Public Works, Hon. Harry A. Bruce, in September, 1932, in the presence of a large gathering representative of the Tableland areas and of the coastal areas from Cairns to Innisfail, was

regarded as an important event in the progress of North Queensland, and a number of motor cars from the coastal area negotiated the difficult temporary connecting track between the "K" Tree and the bridge. This bridge is situated just below the junction of the Beatrice and Little Beatrice Rivers, and its surroundings present a scene of almost unrivalled beauty, with mountain streams pouring in rapids over granite boulders through tropical jungle. The bridge was constructed largely by unemployed relief work under the supervision of Shire Engineer Macarthur, directed by the then Northern Engineer of the Commission, the late Mr. J. M. Fraser.

The new road now in process of construction is located so as to contour the spurs on easy grades between the Christy Palmerston track and the North Johnstone and Beatrice Rivers.

Works are also proceeding rapidly in the East Palmerston area with access to Innisfail. The land of that area is rich red volcanic soil, covered with tropical jungle, and comprises an area of approximately 10,000 acres.

Maalan, Culpa, Boonjee, El Arish, and Julatten Areas.

The policy of developing the above areas on similar lines to the Palmerston has now been approved, and surveys and construction to that end are proceeding.

The Culpa area, which the Government proposes to open, comprises an area of some 50,000 acres, and its access is naturally to Ravenshoe by a road which will shortly be under construction via the Tully Falls, which rank in grandeur with the Barron Falls. This road, in addition to developing large areas, should greatly assist the tourist trade of North Queensland.

Mount Spec Road.

This work has proceeded steadily by unemployed relief labour in continuation of the work inaugurated by the previous Government. The photograph illustrating the construction of an arched masonry bridge at Little Saltwater Gorge is an illustration of the high quality of work which can be achieved by such labour skilfully directed.

Chinchilla, Wondai, Mundubbera, and Millmerran Areas.

The work of clearing roads to serve these areas was undertaken by the Shires concerned, under the direction of the Commission, with State and Commonwealth funds for the relief of unemployment, which were provided upon the recommendation of the State Employment Council previously referred to. Very little of the work was actually upon declared main roads, but upon feeder roads thereto.

A total of 287½ miles of road was so cleared, and in some instances roughly graded, for an amount of £21,915 18s. The country served comprises brigalow and belar lands previously heavily infested with prickly-pear. A considerable mileage of similar work in the Millmerran area has been cleared by the Lands Department, and the survey of the main roads in that area is proceeding.

Eungella Lands.

An agreement has been reached with the Lands Department that the first section of the main road which junctions with the Eungella Range road shall be constructed by the Public Estate Improvement Branch of that Department in accordance with the surveys, plans, and specifications of the Commission, the Lands Department carrying on the work in conjunction with its pioneer feeder roads. The Mirani Shire Council has agreed to this arrangement.

Hervey's Range Road.

A continued agitation by tobacco growers for a road of access up the Hervey's Range, near Thornton's Gap, was met by the Government granting special funds under section 19 of "*The Main Roads Acts, 1920 to 1929*," to the extent of £14,500. It has been possible to provide only a narrow one-way traffic road on easy gradients.

The declaration of the range section as a main road before construction was not considered reasonable in view of the obligations upon the Main Roads Fund and the Shire of Thuringowa. Since construction, however, the road has been taken over as a main road, thus ensuring its proper future maintenance.

Relief to Local Authorities.

It is proposed that, under section 33 of "*The Main Roads Acts, 1920 to 1929*," the local authorities shall be relieved of interest and redemption payments for some years in the case of the opening of virgin tropical lands, such as Culpa, Maalan, Palmerston, and Eungella.

In the case of the Culpa lands, it is considered that special funds should be provided under section 19 of the Main Roads Acts for construction work beyond Tully Falls in view of the large area to be developed.

STATE HIGHWAYS.

Pacific Highway.

The Government approved of the completion of certain works on State highways, and as a result the sections of the Pacific Highway between Southport and Beenleigh, some 8 miles in length, were completed in approximately six months, while the Currumbin deviation, which removes the highway from the narrow and unstable Currumbin sea-front, is well under way.

Lockyer-Darling Downs Highway.

Sections of this highway on the Darling Downs have been rapidly completed, and the programme of construction for the year 1933-34 provides for further works, both on the Downs and on the Lockyer.

Darling Downs-Burnett Highway.

The Darling Downs-Burnett Highway (Kingaroy-Bell section) is now completed in Kingaroy Shire, with the exception of such surfacing work as may become necessary from time to time.

Extensive works between Porter's Gap and Bell have been completed, and further works are in hand and projected. The total cost of construction of the completed highway will represent only about one-third of the estimated cost of the once projected railway, whilst at the same time the road has allowed of more intensive local development in the adjacent area than would have occurred if a railway had been built. The main road revenues, moreover (which are largely derived from the general road user and adjacent landowners), are ample to take care of full interest and redemption on its costs and to provide for its proper maintenance.

Cook Highway (Cairns-Port Douglas-Mossman Section).

This road, which was commenced by unemployed labour during the era of the last Government, has been rapidly pushed ahead by contract from the Port Douglas end, and by day labour from the Cairns end. It is anticipated that the road will be sufficiently completed early in 1934 to allow through traffic, thus breaking the isolation from which the Mowbray area at Port Douglas and the Mossman and Daintree areas have been suffering.

Extensive planting of cocoanuts and other tropical trees has been carried on adjacent to the road. The highway at times contours the rough spurs leading down to the beaches from the "Heights of Victory" (so named by Captain Cook), and at others traverses close to the beaches, and has been declared by a leading road authority as likely to be one of the finest coastal highways of Australia. I have no doubt but that its construction will lead to the use of much undeveloped scrub land north of Mossman, and ultimately north of the Daintree River.

The construction of the Stratford Bridge over the Barron River, near Cairns, is well in hand, and will materially shorten the above route and at the same time assure access to much land at the Barron Delta.

Carnarvon Highway (Injune-Rolleston Section).

This road is designed to open up stock route communication between the southern and central-west, as well as for general traffic and communication to station properties.

Close liaison has been established with the Land Administration Board as to its requirements, and surveys of a considerable proportion of the route have been completed. It is hoped to commence road works during the financial year 1933-34. This project is one of those recommended to the Government by the Bureau of Industry.

Surat Highway (Surat-Glenmorgan Section).

The relief works inaugurated at the conclusion of railway construction to Glenmorgan have been steadily continued. Although 20 miles or so of the road are now trafficable in all weathers as the result of recent construction, much work in black soil areas still remains to be done before full use of the road is obtained. The road, even in its incomplete state, is of great value to the Surat district, giving, as it does, very direct access to the railhead at Glenmorgan on the shortest rail route to Brisbane.

Leichhardt Highway.

Works are steadily proceeding, and the journey between Taroom and the railhead at Wandoan may now be completed under two hours, even in wet weather, as against half a day (with the certainty of being bogged) a few years ago.

South-Western Highway.

Work has gone ahead on this section during the year, and all-weather communication between Thallon and St. George is now almost an accomplished fact. Further west, isolated bad sections have received attention.

Burnett-Condamine Highway.

It is proposed during the year 1933-34 to recommend the gazettal of a State highway between the Burnett and Condamine districts. A long length of road previously declared as a main road in the Shires of Wondai, Wambo, and Chinchilla will be consolidated into the State highway, which passes across the Dividing Range through a very large area of land which it will aid in intensive development. This area consists of the brigalow and belar scrubs in the Durong and Burraburri area, the subsidiary roads of which were cleared under the Commonwealth-State Unemployment Scheme previously described.

The road has been so located as to give the easiest access to the various towns and butter factories at the least expense and with the least amount of travel to settlers, but its future use will be of a much wider nature than to these settlements —possibly wider than that of the Kingaroy-Bell section of the Burnett-Darling Downs Highway—for it will establish ultimate communication between centres so wide apart as Chinchilla and Wondai.

Before the opening up of the impassable scrub barrier by roads in the Durong area and the building of Cockerill's Crossing bridge over the Boyne River which was completed over two years ago, the people of the Burnett and, say, the Chinchilla districts were almost as alien to one another as are the people of China and Japan. The distance by rail from Wondai to Chinchilla is 393 miles, and via the route of the proclaimed highway 102 miles.

Ayr Shire—Ayr-Rita Island Road.

Amongst many important works on roads other than those previously referred to, mention may be made of the construction of a timber bridge, consisting of thirty-four 30-feet spans 16 feet wide, as a dual purpose road and tramway bridge over an anabranch of the Burdekin River. It had been hoped that the bridge might have been utilised for tramway purposes during the present sugar-cane crushing season, but the contractor had not progressed far enough to allow this. The construction of the bridge is being subsidised by the Kalamia Estates, with a view to the elimination of the almost annual renewal of the low-level tramway crossing of the anabranch.

Heat Treatment of Soils.

The Irvine process and machine has been employed continuously since the completion of the Walloon road experiment upon a black soil section of the Lockyer-Darling Downs Highway, between Gatton and Grantham, under conditions which will approximate to its wider use in the Western areas.

Mr. Irvine has made considerable improvements in the machine and in its method of working. On this particular job the machine is under hire from the patentee, and the method of work is directed by the Commission's engineers. The speed of operation has been more than doubled without appreciable diminution in the efficiency of burning operations, and with only a small increase in the quantity of wood fuel consumed.

The results of the work are referred to in the report of the Chief Engineer. The Main Roads Commissioner of New South Wales has kept in close touch with all operations, and with your approval, negotiations are in progress jointly with him in relation to the acquisition of the right to use the patented processes and machines, and for the design of improved machines by the use of which it is hoped to reduce costs further and to improve the material resulting from the treatment. It is sufficient here to say that the results achieved to date have been more satisfactory than was anticipated, and it has already been established that the cost of production is such as to warrant the use of the process on Western plains where fuel is available at a reasonable price, but where metal or gravel is unobtainable except at prohibitive cost.

The improvements expected from machines to be designed which will embody the results gained by our experience may lead to a much wider application of the process.

At the existing rate of progress of 2,300 feet per week of 6-feet width, the cost of material does not exceed 12s. per cubic yard of burned material (loose). The material has in service on the highway proved to be an excellent base course upon black soil. By means of a second story burn on Western plain country the necessary thickness of material to withstand traffic without the use of any top course metal should easily be obtained.

Maintenance of Roads.

It is to be again emphasised that the best and cheapest method to ensure the adequate maintenance of constructed sections of roads—whether gravel, metal, or bitumen surfaced—has been by the employment of the regular patrol system. In cases where this method has not been adopted the roads are not in nearly as satisfactory a condition as in districts where patrol men have been regularly working.

It is intended to make definite requests to all councils having a reasonable length of constructed road to put the system in operation in the near future. Compliance with the request will benefit the interests of the councils concerned, this Commission, and the travelling public generally.

A Tribute to the Road Workers.

Mr. Kemp concludes his report with this fine tribute to his men:—In conclusion, I desire here to thank the whole staff, from the Chief Engineer downwards, for their extra efforts during the past year, during which many additional responsibilities have fallen to their lot. Owing to their unflagging efforts and to the efficiency and keenness of workmen, the quality of work has improved and costs have been further reduced.

Work of very high quality indeed has been produced in some instances by unemployed relief workers, as, for instance, in the construction of the masonry-arched bridge over Little Saltwater Gorge on the Mount Spec road, referred to elsewhere. Particularly fine, also, has been the work carried out by relief workers on the Darling Downs and in scrub and mountain areas such as Nerang, Palmerston, and Western districts.

Plate 149.—Cairns-Port Douglas Road under Construction.

PLATE 150.

PLATE 151.

These photographs illustrate the scenic appeal of the coastal highway now under construction between Cairns and Port Douglas. The completion of this road will definitely break the isolation suffered in the past by the Port Douglas, Mossman, and Daintree areas.

PLATE 152.—DOUGLAS SHIRE—COOK HIGHWAY.
A tropical scene on the Mossman-Daintree section of the Highway.

PLATE 153.—CARDWELL SHIRE—TULLY RIVER-NORTH BANK ROAD.
The luxuriant tropical foliage abutting the road has been preserved in its virgin state. The road serves a sugar district and a seaside resort.

PLATE 154.—THURINGOWA SHIRE—MOUNT SPEC ROAD.
A masonry arch bridge built entirely by relief workers.

PLATE 155.—PINE SHIRE—NORTHERN HIGHWAY.
Showing the grading of the Mountain section between Dayboro' and Mount Mee (1,732 ft.). Note the developmental road breaking off to serve the northern end of the mountain.

PLATE 156.—TIARO SHIRE—TIARO-GLENBAR ROAD.

A low-level bridge over the Mary River to provide access for a dairying and agricultural district. Note the especially strong concrete piers for flood resistance.

PLATE 157.—DEGILBO SHIRE—GOOMERI-CHILDERS ROAD.

A view from the Ban Ban Range, showing the closely-settled Coalstoun Lakes farming area.

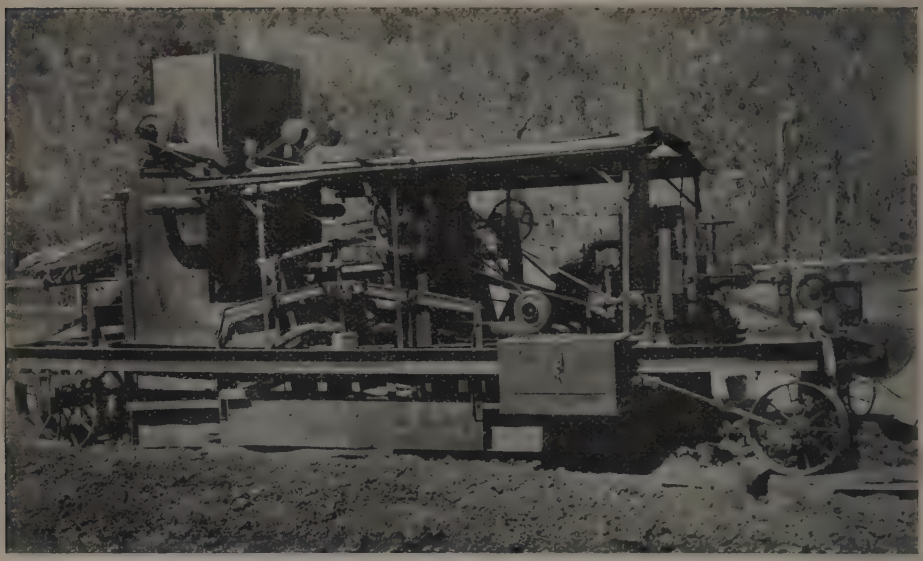

PLATE 158.—THE IRVINE TRAVELLING FURNACE IN OPERATION FOR THE "IN SITU" BAKING OF CLAY SOILS.

PLATE 159.—ROSEWOOD SHIRE—WALLOON-HAIGSLEA ROAD.
A section completed by the use of the Irvine Heat Treatment process.

Plate 160.—Tarampa Shire—Lockyer-Darling Downs Highway (Brisbane-Toowoomba Section).
A further section of road effectively treated by the heat process.

Plate 161.—Caboolture Shire—Caboolture-Beachmere Road.
The old bridge over King John Creek.

PLATE 162.—CABOOLTURE SHIRE—CABOOLTURE-BEACHMERE ROAD.
The new bridge recently erected by the Main Roads Commission.

PLATE 163.—MONTO SHIRE—MONTO-THANGOOL ROAD.
A standard type of M.R.C. cattle grid near Coominglah.

PLATE 164.—ROSEWOOD SHIRE—LOCKYER-DARLING DOWNS HIGHWAY (BRISBANE-TOOWOOMBA SECTION).

Hospital Hill, Marburg—a section previously in very rough condition but now in good order through the use of relief labour.

PLATE 165.—TAROOM SHIRE—LEICHHARDT HIGHWAY (TAROOM-WANDOAN SECTION).

A typical section gravelled by contract to the benefit of a pastoral area.

PLATE 166.—CHARLEVILLE TOWN—CENTRAL HIGHWAY.

A reinforced concrete bridge over the Warrego River which provides access to the railway for a western pastoral area lying between Charleville and Adavale.

PLATE 167.—GLENGALLAN SHIRE—LOCKYER-DARLING DOWNS HIGHWAY (TOOWOOMBA-WARWICK SECTION.

A cement penetration job over heavy black soil in a farming area. Top course metal assembled ready for grouting.

Plate 168.—Glengallan Shire—Lockyer-Darling Downs Highway (Toowoomba-Warwick Section).
The slab completed (except for final trimming) and opened to traffic.

Plate 169.—Clifton Shire—Clifton-Hirstvale-Grantham Road.
Illustrating the deposition of silt after a heavy downpour of rain. The undamaged road is shown in the background.

PLATE 170.—EACHAM SHIRE—MILLAA MILLAA-INNISFAIL ROAD.

The McHugh Bridge over the Beatrice River, opened to traffic by the Minister for Public Works (Hon. H. A. Bruce) on 8th October, 1932. This bridge is the essential link between Millaa Millaa and the Palmerston area.

PLATE 171.—WATERFORD SHIRE—NEW ENGLAND HIGHWAY (BRISBANE-MOUNT LINDESAY SECTION).

A section between Brown's Plains and the McLean Bridge.

Plate 172.—Cleveland Shire—Capalaba Road.
A cement penetration section on a flat subject to flooding. The road serves a fruit-growing and tourist area.

Plate 173.—Monto Shire—Monto-Thangool Road.
This road, which is being constructed in waterbound macadam, links up the Maryborough-Monto railhead with the Dawson Valley Line.

PLATE 174.—GYMPIE CITY—MAIN GYMPIE ROAD.

A scene reminiscent of military road construction in Flanders. During the third Battle of Ypres, in 1918, Australian Pioneer battalions made 10 miles of metal road and 18,300 yards of plank road in twenty-seven days—an outstanding feat in military engineering.

PLATE 175.—GYMPIE CITY—MAIN GYMPIE ROAD.

These two pictures show a cement penetration job in progress on a section subject to flooding at the entrance to Gympie.

WORMS IN SHEEP.

FOR the purposes of these notes we may confine ourselves to three worms as being most prevalent where the parasite gives trouble in Queensland.

These are the Stomach Worm (*Hæmonchus contortus*), the Nodule Worm (*Oesophagostoma columbianum*), and the Tape Worm (*Tænia expansa*). The presence of worms in a flock should be readily detected by the careful flockmaster. Usually there is a falling-off in condition for no apparent reason, a decided tail appears in the flock, and upon examination the membrane of the eye is noticed to be unduly pale, likewise the skin. Scouring may occur, and there is often a decided lump in the back of the affected sheep. There is a generally anæmic appearance, and in far-advanced cases a "bottle" appears under the jaw. Post-mortem examination will show the presence of stomach worms in the fourth stomach. Nodule worms will be detected by the presence of pimply-like lumps on the intestines varying in size from a pin's head to the size of a small pea. Tape worms inhabit the intestines, and grow in some cases to a great length, 12 feet being no uncommon.

In all three cases the remedy lies in systematic drenching.

The following drenches are recommended:—

(1) 2 oz. arsenic (98 per cent. pure), 4 oz. bluestone, 6 lb. Epsom salts, 5 gallons water.

Doses.—Grown sheep, 2 fluid oz.; 9 months to 15 months, 1½ fluid oz.; lambs (weaned), 1 fluid oz.

(2) 2 oz. arsenic (98 per cent. pure), 6 lb. Epsom salts, 5 gallons water.

Doses.—Grown sheep, 2 fluid oz.; 9 months to 15 months, 1½ fluid oz.; lambs (weaned), 1 fluid oz.

(3) 1 lb. fresh mustard, 1 lb. bluestone, 10 gallons water.

Doses.—Grown sheep, 4 fluid oz.; 9 months to 15 months, 3 fluid oz.; lambs (weaned), 2 fluid oz.

(4) Carbon tetrachloride, 2 c.c.'s; paraffin oil, 3 c.c.'s—for grown sheep.

To prepare No. 1 drench, boil the arsenic and Epsom salts in about 3 gallons of water, constantly stirring. Dissolve the bluestone in some of the water, and add when all ingredients are thoroughly dissolved. Make quantity up to 5 gallons.

No. 2 drench is prepared in the same manner, and is, in fact, the same except for the absence of bluestone.

No. 3 (Mustard and Bluestone).—Mix the mustard in sufficient water to make a thick paste, adding more water from time to time. Dissolve the bluestone separately and mix the two together, making the whole up to 10 gallons. Properly-graded drenching vessels should be used in the administration of drenches.

The head of the sheep should not be raised further than necessary, and the animal should stand squarely on all four feet.

When using carbon tetrachloride and paraffin oil, a specially constructed syringe is recommended, the object being to get the drench right at the back of the throat. In the cases of drenches 1, 2, and 3, sheep should be yarded and starved for at least twelve hours previous to drenching, and should be kept away from water for four or five hours after drenching.

When carbon tetrachloride is used no starvation is necessary.

Where the infestation is a bad one, two drenches within ten days are advocated.

TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the Journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

THE POINTS OF A GOOD HORSE.

A writer in the "Live Stock Journal" (London) makes the following observations, which should be of especial interest to Queensland horsemen:—

THE horse is, above all things, an animal with a purpose in life. Some very willingly, conscientiously, or, perhaps, spiritedly, are prepared to perform their duty. Others object, and some there are that refuse. His ability to perform his work will depend upon three things:—

(1) Form.—His whole body, legs, angles, and feet must be so constructed as to enable him properly to perform the duties required of him.

(2) Construction.—His heart, lungs, digestion, and circulation must be such as to ensure endurance and stamina.

(3) Temperament.—His breeding usually will determine his intelligence, courage, disposition—in short, all that goes to make up the character of an animal that any horse lover would wish to own.

What a Judge must know.

A judge, then, must be familiar with all the curves, angles, muscles, joints of a horse's anatomy, in order that he may be in a position to understand or to estimate how certain conformations will stand up under strain and wear under test.

He must, further, know, by continuous handling, whether the hoofs are of the best texture and shape; whether the pasterns and shoulders are properly sloped; whether the points are well formed and free from unsoundness; whether the general type of the horse is such as to ensure service ability. Again, he must be familiar with faults of the eye, of the wind, of the digestion, of the circulation, so that he knows at once, or by careful test, how the animal is likely to measure up under different conditions of work and feed.

Still further, he must be able to read a horse's character; to determine his disposition; to decide whether he has the heart and intelligence to continue proven and dependable under difficult or trying circumstances.

Does he Fill the Eye?

How, then, are we to judge a horse? In the first place, take him as he stands. How does he measure up under first inspection? Does he fill the eye? Does his whole form satisfy your judgment as to what it should be? We expect to find a clean-cut head, full nostrils, firm lips, depth and width at the angle of the jaw, full clear eye, broad forehead, erect ear.

There must be no thickness at the junction of the neck with the head. The neck should be reasonably arched, of fair length, and filling full into the shoulder.

Constitution is indicated by depth and fullness in the chest. The shoulder should be long and sloping, and blend perfectly into the body. The rib should be well sprung, closely knit, and carry well down, giving the appearance of depth and compactness of form. The back should be short and well muscled, while the loin should be short, broad, and look closely coupled.

The croup should be long, muscular, and straight, and the thighs deep, full, and plump, with muscle extending well down towards the hock. The quarters, viewed from behind, should carry such a mass of firm, hard muscle as to give the appearance of a strong and compact ham or hindquarter.

The First Look.

The first general view of the horse should be such as to fix the impression as to his form and to enable the judge to accurately determine his constitution, temperament, and character. The form, no matter what may be his class, should indicate compactness, strength of muscling, together with symmetry of outline.

The horse's disposition will be determined by the apparance of the eye, carriage of the head, fullness of the forehead; in the energy or activity in every movement of the body and the alertness of his position even when standing at ease.

The supreme test of a horse, however, lies in an examination of his feet, legs, and action. The closest, most critical inspection must be given to these features in arriving at a judgment as to a horse's value. Now view him from in front. The forelegs should be straight and set well under the horse. This will indicate compactness of conformation, and provide for control in action. Viewed from behind, the museling of the quarters will be observed, and the set of the hindlegs must be noted. Dropping a plumb-line from the point of the buttock, it should be found to divide equally the hock, cannon, pastern, and foot. Careful study will indicate the proportion that should be sought between the length of quarter and of cannon bone, the slope of pastern, and the conformation of the foot.

What Legs and Feet Mean.

The legs and feet should now be minutely examined. The arm should be compact and muscular, and the forearm relatively long from the elbow to the knee, thus providing free and easy action. It should be noted that the forearm is free at the elbow, and its muscular development may be taken to indicate the general strength of the horse.

Breadth in the knee is desirable, and its outline should be clearly defined and prominent. Depth from the front to back is expected, and there must be no tendency towards calf knee or knee sprung. The cannon should be wide, short, and full below the knee in order to give the latter proper support.

The combination of sinew and bone in the cannon should present a flat, hard, clean, well-defined appearance, thus indicating quality and proper texture throughout. In breeds with feathering the hair should be fine, soft, and silky. The pasterns will be found usually of a similar angle to that of the shoulder, and straight pasterns are therefore very undesirable. They should be sloping, strong, and of proportionate length. The texture of the feet must be carefully observed.

The hoof head should be full, rounded and free from defect; the heels of good depth; the frog prominent; and the sole of the hoof concave. This is one of the most sensitive and most intricate mechanisms of the body, and its size, shape, and texture must therefore be carefully considered.

In examining the hind legs, conformation of the hocks should be particularly noted. They are frequently seats of disease or injury, and poor conformation in this region cannot be forgiven. The outline should be clearly defined, the point prominent, and there must be no gumminess or meatiness whatever. The cannons should be wide, short, and clean, and found to properly support the hock. Reasonable slope in the hind pasterns is desirable, and they should be strong and of proportionate length. The hind feet must be examined as to size, texture, and conformation in the same way as the foreleg.

Movement Tells Much.

The horse in action should be observed at the walk and trot. This is the final test, and is one of the most important. Sluggishness and indifference in movement seriously detract from the value of the animal. Firm, erect, alert carriage, coupled with strong, steady, free movement, present a combination that carry their own recommendation.

At a walk a horse should pick up his feet cleanly and firmly, and put them down again as though always under control. He should move straight away, the legs being carried straight under him and reasonably close together. The action of the muscles in flexing the foot should be carefully noted. Deflection to the right or to the left at the toe, knee, or hock denotes lack of control or improper balance, seriously interfering with the levelness of action.

At the trot the same regular, controlled movement should be observable. Clean, straight going is in keeping with proper conformation in the legs and feet. Careful study of action suggests the spirit, temper, disposition, utility, and endurance of a horse, and is never to be dissociated from its relationship to structure and conformation.

PASTURE IMPROVEMENT AND DAIRY PRODUCTION.

Subjoined is a report of an address by Mr. P. Waller, manager of the Berry Experiment Farm, at a recent Illawarra district conference, under the auspices of the Agricultural Bureau of New South Wales. Mr. Waller discussed pasture improvement from two aspects, namely—(1) *Its general influence on animal health; and* (2) *the possibilities of producing high-grade fodder for dairy stock.*

FOR over one hundred years, Mr. Waller said, heavy grazing and soil erosion had been depleting the coastal grazing lands of their fertility, while no attempt had been made to put back what was being removed. It was little wonder that these lands were becoming less productive each year, that the growth came later each spring, and the cattle were becoming unthrifty and disappointing in both appearance and production. Dr. Woodman, of Cambridge University, had shown that a cow giving about 300 lb. of butter-fat per annum required for her needs: Nitrogen, equal to 450 lb. sulphate of ammonia; phosphoric acid, equal to 150 lb. of superphosphate; potash, equal to 130 lb. of 20 per cent. potash salts; and calcium, equal to 130 lb. of carbonate of lime. It was only natural that the enormous drain on the soil fertility would make its presence felt; and to-day the clovers and high fertility demanding grasses like rye became starved out of even the best pastures, with the result that the carrying capacity of the land was decreasing fast, the cattle often manifested depraved appetites by chewing bones, sticks, &c., while in other cases there occurred "strange diseases" such as various kinds of lameness, stiff or enlarged joints, sprains, enlarged spongy bone, and in extreme cases, even broken limbs. These were all evidences of mineral deficiency.

The Value of Minerals in the Ration.

Discussing the purpose of minerals Mr. Waller said that three, viz., phosphorus, potash, and calcium were removed from the soil in large quantities in milk and other animal products. As they existed in the soil in comparatively small proportion and could not be absorbed from the air, and they were essential to enable the animal to build up a healthy body, it naturally followed that they had to be artificially supplied. Minerals were important in enabling the soil to produce and utilise abundant supplies of humus, a valuable soil constitutent for successful cropping or pasture improvement. Fortunately, at least two important components of any pasture, or fodder, viz., the carbohydrates and the protein could be obtained largely from the atmosphere; by the growing of legumes and by efficient cultural methods it was possible greatly to increase the amount of protein in the pasture.

It was fortunate that most of our pasture land contained sufficient potash for present needs, but there was a singular shortage of phosphorus and calcium in most dairying districts.

Phosphates were the most important mineral ingredient of the body, and they were supplied only by the food used. Hence it was essential that the food should be rich in phosphates. The use of lime for livestock was increasing daily because its importance had never been so clearly demonstrated as at present. Some land had enough lime for the growth of crops, but there was not any where an application of lime would not benefit the animals grazed thereon. Even soils rich in lime rapidly became depleted of it when under constant cultivation or grazing; it was often found that ground limestone gave a good response on land containing limestone grave or pebbles. At Berry Experiment Farm, soil samples taken prior to laying down the pastures four years ago revealed that choice alluvial loam was deficient to the extent of 2 tons of lime per acre, while the poorer clay soil required up to 10 tons of lime to make up for its calcium deficiency.

Lime not only supplied the calcium needs of the plant, but by neutralising acidity created favourable conditions for the growth and activity of soil bacteria which fixed atmospheric nitrogen. It also prevented the reversion or waste of superphosphate in the soil, liberated potash, and improved the soil texture which largely governed its water-holding capacity.

The animal body made desperate efforts to keep the calcium supply of the blood up to normal, and where there was not enough in the food, the bone structure was drawn upon, hence the reason for weak bones. It had been proved that, no matter how well a cow was fed before calving, she was unable to assimilate enough lime for her bodily needs and heavy milk production. Hence a cow could not milk profitably for long, unless she had a big reserve of calcium. Any deficiency in lime in the fodder was quickly reflected in the health of the animal. Where phosphates and lime were deficient, the animals developed the habit of chewing bones, and this rendered them liable to poisoning by "botulism," a toxic

principle secreted by the *bacillus botulinus*. Experience had shown that in such cases best results were obtained by the application of properly balanced fertilizers to the pastures, since the minerals were first metabolised by the plants, and then used by the animals in the best form for assimilation.

Sowing Pasture Grasses.

Mr. Waller then discussed methods of establishing and managing sown pastures, the following being extracts from this portion of his paper:—

When we adopt the practice of topdressing it is of prime importance that we have the best grasses available in order to get the best results from the fertilizers applied; thus we cannot get good results from paspalum in winter time, no matter how well it may be topdressed. Therefore, we plant winter-growing types like prairie, cocksfoot, rye grass, Subterranean clover, &c., which will furnish plenty of well-balanced pasture during cold weather and until the paspalum comes along to supply the herd during summer. Thus by proper management we can have two crops growing in the same soil and without the labour of ploughing for them, for this is what pasture management represents to the farmer who gives proper attention to his grazing land.

Pastures may be sown down after careful preparation of the land as for any other crop, or the seed may be broadcasted and harrowed after a vigorous renovation of the paspalum sod; the former method, though expensive, will give winter feed in three months' time, while it takes about twelve months for the plants to become established when sown after renovation only. In either case, the fertilizers are applied prior to sowing the seed and where possible shortly after rain, so they may be rapidly absorbed in order to obviate the risk of windy weather causing the lighter particles to rise and blow away.

If Subterranean clover is sown early in autumn, and fertilizers applied, it will produce good feed during winter, and at the same time it will be found to enrich the soil quite appreciably and encourage the growth of high fertility grasses like rye, to the detriment of useless weeds like Parramatta grass.

The establishment of young pastures will be assisted by applying 1 cwt. of sulphate of ammonia per acre; this will ensure a valuable growth of winter pasture, having a feed value closely approaching that of concentrates such as bran or crushed linseed, which it largely displaces during winter feeding.

Management of pastures comprises the entire treatment necessary to maintain the pastures in a maximum state of efficiency throughout the year. Briefly, it includes the subdivision into small paddocks to permit rotational grazing of the young grass, followed by the removal of all stock and the harrowing of the paddocks to thoroughly spread the animal droppings so that they are again rapidly incorporated into the soil as fertility for the supply of subsequent grazing.

If the droppings are not harrowed regularly after each grazing they produce patches of rank growth of grass which are left by stock throughout the entire season. This condition increases with each successive grazing and results in the loss of a large portion of valuable grazing area; it frequently happens that much of this manure-covered land, if not harrowed, may not be available for years unless the droppings are ploughed in or removed in some way. After careful observation it has been calculated that the year's manure from thirty cows contain fertility equal to that found in the following commercial fertilizers:—9 tons of sulphate of ammonia, 2½ tons of superphosphate, 4½ tons of sulphate of potash. At present prices, these would be worth approximately £200 per year to the farmer, and would represent a very real contribution towards his farm's upkeep, whereas, if allowed to remain undisturbed, the manure limits the capacity of his pasture; thus the value of using grass harrows becomes very apparent.

Cost of Treatment.

The annual cost for fertilizers which, in our experiment gave the most economical result, viz., ½ ton of lime every three years, 2 cwt. superphosphate per year, 2 cwt. sulphate of ammonia yearly, was as follows:—Lime (at 32s. per ton), say, 6s.; superphosphate (at £5 per ton), 10s.; sulphate of ammonia (at £12 per ton), £1 4s.; total, £2 per acre yearly.

Production per Annum at Berry.

Treated and managed paddocks produced 219 lb. fat at 10d. per lb. = £9 2s. 6d. per acre yearly; untreated but managed paddocks produced 118 lb. of fat per acre at 10d. per lb. = £4 18s. 4d.; untreated and unmanaged paddocks produced 25 lb. per acre at 10d. per lb.= £1 0s. 10d. per acre. Thus we found a profit of £7 2s. 6d. per acre yearly above cost of fertilizers, or, viewed another way, it represents to us the striking fact that by using fertilizers we made a return of £2 4s. 2d. per acre more than was earned by the untreated areas for the year. In addition to this we had the satisfaction of knowing that our treated land was still better at the end of the season than the untreated, and that the cattle were better for having grazed on the former.

Further evidence of the value of pasture improvement is indicated by the past season's production; this is of special interest, since it includes many heifers which are the progeny of the first animals reared on our treated land and show a notable improvement in both appearance and production.

Average production for the year ended 30th June, 1927: 7,562 lb. milk testing 3.6 per cent. = 272 lb. fat per annum for each cow; while the average production for year ended 30th June, 1933: 8,910 lb. milk testing 4.22 per cent. = 376 lb. fat per annum for each cow.

THE IDEAL SHADE FOR PIGS.

The type of protection from the heat of the summer sun recommended by the Waikato Pig Recording Club (New Zealand) is here illustrated. It is made on the fence line with three posts in either field and a few pieces of timber, taken from post to post, to carry bundles of ti-tree. The air circulates through the ti-tree, making for a very cool condition in the shelter. The photograph was taken on the farm of Mr. J. D. Browning at Orini.

It should be unnecessary to emphasise the value to pigs of shade in the summer, especially for pigs rapidly reaching a marketing weight. The pig has no fur or much hair to protect it while it has no sweat glands. Thus it feels the effect of the heat more perhaps than any other animal. This is why it loves to

PLATE 176.

wallow in mud. But a pig would obtain much better protection from the sun's heat, and be much less adversely affected by it, if it had the cool shade provided in the manner illustrated. Nothing possibly could improve on the ti-tree bundles, as free circulation of air through the roof make for the ideal conditions for a pig seeking protection from the heat. It will be seen from the photograph that quite a quantity of ti-tree was used. A much less quantity could be effective as the circulation would be thereby increased. If made up in the same manner as for fascines it could be easily handled and would require less support, necessitating only the use of four posts.—"The New Zealand Farmer."

A TALK TO JUNIOR CLUB MEMBERS.

PRIMARY production constitutes the basic industry of this State. The dairy section alone involves 24,000 individual farms, with, approximately, 100,000 people domiciled thereon. The product of their activities is, in round figures, of an annual value of £7,000,000 On this industry depends wholly or partly other enterprises of manufacturing, transportation, trade finance, and commerce.

To give adequate service to the industry its problems must be viewed in their proper perspective and solved by procedure based on experience and knowledge, gained by the application of practical methods.

The problems of the primary producer are many and complex, embracing principles of agriculture, livestock breeding, feeding, and management, also the marketing of the products. No institution, educational or regulatory, can prescribe cut-and-dried remedial measures in the solution of the difficulties that arise. The present instability of international trade, commerce, and finance has affected agriculture to an extent greater than ever before, and it has been found necessary to make adjustments to meet the difficult marketing conditions. World-wide economic conditions cannot be changed through the administration of local bodies controlling dairy activities.

The various boards associated with primary industry cannot find markets where they do not exist. Agricultural and dairying enterprises, as in other branches of industry, must make essential adjustments, eliminate waste, and standardise their output, and thereby secure a full measure of industrial efficiency, while awaiting essential economic readjustment within the Commonwealth and a stabilisation of the world's market for primary products.

Such readjustment lies beyond the scope of the primary industries concerned. The legality of the marketing charter instituted under the provisions of the Primary Producers' Organisation and Marketing Act has been challenged, and the various activities that have developed under the provisions of that charter are being examined more critically than ever before.

In determining what are essential activities, it is only proper to consider carefully education and research along with other phases of the industry. Any review must be made with a constructive purpose.

To determine the wisdom of and to measure accurately the value of the application of modern methods to agriculture and dairying is not an easy matter, owing chiefly to the general disorganisation of trade and commerce throughout the world.

The dairying industry in Queensland has kept in step with dairy research, increased production, and improved quality, but it has been found that such a betterment has not increased returns to the dairy farmer. In order to determine definitely the value of dairy research it is essential to analyse the incidence of its application to the various phases of the industry. The extension of the industry, improvement of quality, and increase of output cannot be interpreted in terms of additional return to dairy farmers as a body, although from the viewpoint of the individual it may represent a distinct gain.

The progressive dairy farmer who obtains a high yield from the individual animals that constitute his herd, and who delivers a high grade product, is, other things being equal, in a better position than one who obtains lower yields from his herd, and who delivers a product below first grade.

Improved technique in dairy practices which brings about an actual saving in the cost of production widens the gap between costs and prices. An example of the saving that is possible by herd improvement is shown in the tabulated records of animals in three dairy herds, and which are included in these notes.

As individual members of a junior club you may reason that there is not much that you can do to improve world's prices for dairy products, and so put the dairying industry on a more advantageous footing and bring the industry a fuller measure of prosperity. Members should realise, however, that they can accomplish something on a small scale. You can, for example, induce dairymen to stop criticising unfairly the activities of fellow dairymen, and organise in furthering the interests of primary producers, realising that the solution of your problems will be found in close and sincere co-operation. Organisation is the price of progress and prosperity, and without it farmers cannot hope to receive a fair reward for their labours.

Through co-operation much can be done to put farm problems before primary producers in their true perspective and point the way to their solution. Industry without education and training in the control of its various activities is doomed to failure, for security and progress are dependent on intelligent application of knowledge and the use of the right technical methods and principles of sound husbandry.

The results of research pertaining to the industry, to be of most value, must be made available to farmers generally, many of whom have never had the advantage of any special training.

Through your Junior Association, by lectures and short courses of instruction and discussions at group meetings, it is hoped to bring constantly before your members information of practical value designed to help the industry in which you are engaged, and so help to solve your difficulties satisfactorily. As a division of the Local Producers' Association the Junior Section should set out to achieve the object of bringing new discoveries, the results of experimentation and research, and their application to the industry, to fellow dairy farmers throughout the State, while, at the same time, taking the fullest advantage of them themselves.

Why High Producing Cows are Most Profitable.

The profitability of high producing cows is shown clearly in the cases cited below.

Which is the best herd?—

22 cows, each producing 200 lb. fat, returning £250 over feed cost;
or

12 cows, each producing 300 lb. fat, returning £250 over feed cost;
or

9 cows, each producing 400 lb. fat, returning £250 over feed cost.

Answer.—9 cows, each producing 400 lb. fat yearly.

Why?

Each herd returns £250 over feed cost.

But—

1. The 22-cow herd produced 800 lb. fat (22 per cent.) more than either of the other herds, which tends to build a surplus and depress prices.
2. The 22-cow herd required 38 per cent. more feed than the 12-cow herd and 58 per cent. more than the 9-cow herd.
3. The 22-cow herd required more time and labour and greater expenses in shelter and taxes than either of the other herds.
4. The 12-cow herd produced butter-fat at a feed cost 24 per cent. lower than the 22-cow herd.
5. The 9-cow herd produced butter-fat at a feed cost of 32 per cent. lower than the 22-cow herd.

CARE OF MILK AND CREAM IN SUMMER.

Generally speaking, greater care in the handling of milk and cream becomes necessary during the summer months. Many dairymen are loth to realise that milk and cream are very delicate substances, that they readily absorb taints and odours, and that their flavour and keeping qualities are easily spoilt.

Scrupulous care must be taken, therefore, to prevent their pollution, not merely by dust, dirt, and flies, and by the minute portions of the stale milk or curd which adhere to vessels unless they are regularly and thoroughly rinsed, scalded, and scoured bright, but also by the smells and taints given off from dung heaps, dirty bails and yards, neglected skim-milk receptacles, and sour milk, rubbish and filth. These should not be allowed to accumulate or remain near places where cows are milked, nor where milk or cream is stored. Furthermore, workers must not be allowed to smoke whilst engaged in the milking shed or milk room, as the smoke taints the milk.

AGRICULTURE ON THE AIR.

Radio Lectures on Rural Subjects.

Arrangements have been completed with the Australian Broadcasting Commission for the regular delivery of further radio lectures from Station 4QG, Brisbane, by Officers of the Department of Agriculture and Stock.

On Tuesdays and Thursdays of each week, as from the 2nd January, 1934, a fifteen minutes' talk, commencing at 7 p.m., will be given on subjects of especial interest to farmers.

Following is the list of lectures for January, February, and March, 1934:—

SCHEDULE OF LECTURES
BY OFFICERS OF THE DEPARTMENT OF AGRICULTURE AND STOCK.
RADIO STATION 4QG, BRISBANE (AUSTRALIAN BROADCASTING COMMISSION).

Tuesday, 2nd January, 1934—"Farm Training." F. O. Bosworth, M.A., Principal, St. Lucia Training Farm.
Thursday, 4th January, 1934—"Banana Thrips." Robert Veitch, B.Sc., F.E.S., Chief Entomologist.
Tuesday, 9th January, 1934—"Building up a Rural Civilisation." J. F. F. Reid, Editor of Publications.
Thursday, 11th January, 1934—"Ticks." F. H. Roberts, M.Sc., Entomologist.
Tuesday, 16th January, 1934—"Observations and Cultural Practices of the Citrus Industry in Queensland," Part I. H. Barnes, Acting Director of Fruit Culture.
Thursday, 18th January, 1934—"Observations and Cultural Practices of the Citrus Industry in Queensland," Part II. H. Barnes, Acting Director of Fruit Culture.
Tuesday, 23rd January, 1934—"Tomato Diseases." R. B. Morwood, M.Sc., Assistant Plant Pathologist.
Thursday, 25th January, 1934—"Garden Pests." J. A. Weddell, Assistant Entomologist.
Tuesday, 30th January, 1934—"Vanishing Assets—Soil and Grass." J. F. F. Reid, Editor of Publications.
Thursday, 1st February, 1934—"Maize Varieties and their Suitability to Certain Districts." C. J. McKeon, Instructor in Agriculture.
Tuesday, 6th February, 1934—"Pasture—Requirements and Composition." E. H. Gurney, Agricultural Chemist.
Thursday, 8th February, 1934—"Chemistry in Agriculture." E. H. Gurney, Agricultural Chemist.
Tuesday, 13th February, 1934—"Products of the Bee Hive." Henry Hacker, Entomologist.
Thursday, 15th February, 1934—"The Plough and the Cow." J. F. F. Reid, Editor of Publications.
Tuesday, 20th February, 1934—"Citrus Diseases." L. F. Mandelson, B.Sc. (Agr.), Assistant Plant Pathologist.
Thursday, 22nd February, 1934—"Harvesting Cotton." R. W. Peters, Experimentalist.
Tuesday, 27th February, 1934—"The Value of the Fruit Industry in Queensland." H. Barnes, Acting Director of Fruit Culture.
Thursday, 1st March, 1934—"Tobacco Soils of Queensland." W. Cartmill, B.Sc., Analyst.
Tuesday, 6th March, 1934—"Papaw Diseases." J. H. Simmonds, M.Sc., Plant Pathologist.
Thursday, 8th March, 1934—"Seasonal Farm Crops." A. E. Gibson, Director of Agriculture.
Tuesday, 13th March, 1934—"Cotton Growing on New Cultivations." R. W. Peters, Experimentalist.
Thursday, 15th March, 1934—"The Colour of Butter and Cheese." O. St. J. Kent, B.Sc., Analyst.
Tuesday, 20th March, 1934—"Pineapple Diseases." H. K. Lewcock, M.Sc., Assistant Plant Pathologist.
Thursday, 22nd March, 1934—"Local Producers' Associations—Their Influence on Agricultural Progress." J. F. F. Reid, Editor of Publications.
Tuesday, 27th March, 1934—"Strawberry Culture." H. Barnes, Acting Director of Fruit Culture.
Thursday, 29th March, 1934—"The Internal Parasites of Sheep." F. H. Roberts, M.Sc., Entomologist.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, the Ayrshire Cattle Society, the Friesian Cattle Society, and the Guernsey Cattle Society, production charts for which were compiled for the month of October, 1933 (273 days period unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
Mature Cow (over 5 Years), Standard 350 Lb.				
Daisy 3rd of Oakvilla	H. Marquardt, Wondai	11,005·26	415·122	British Admiral
May 2nd of Oakvilla	H. Marquardt, Wondai	10,589·4	387·699	Victory of Greyleigh
Senior, 4 Years Old (over 4½ Years), Standard 330 Lb.				
Scarlet of Trevor Hill	George Gwynne, Umbiram	10,770·8	422·251	Prince of Braemar
Junior, 4 Years Old (under 4½ Years), Standard 310 Lb.				
Rosenthal Maggie 11th	S. Mitchel, Rosenthal	8,229	335·549	Sunrise 3rd of Rosenthal
Senior, 3 Years Old (over 3½ Years), Standard 290 Lb.				
Thornleigh Pet 8th	C. O'Sullivan, Greenmount	8,142	314·081	Cosey Camp Alma's Beau
Junior, 3 Years Old (under 3½ Years), Standard 270 Lb.				
Navillus Amy	C. O'Sullivan, Greenmount	8,101·75	309·085	Charmer of Glenleigh
Senior, 2 Years Old (over 2½ Years), Standard 250 Lb.				
Dahlia of Trevor Hill	A. E. Vohland, Aubigny	7,574·8	287·521	Prince of Braemar
Wandegong Empress	G. D. Lindenmayer, Binjour	6,385	262·99	Emperor of Spurfield
Junior, 2 Years Old (under 2½ Years), Standard 230 Lb.				
Trevor Hill Starlight	G. Gwynne, Pittsworth	9,179·55	376·897	Gambol of Wilga Vale
Sunnyview Ida	R. Tweed, Kandanga	8,578·15	373·508	Lovely's Commodore of Burradale
Kingsdale Dulcie 12th	A. A. King, Mooloolah	7,899·1	329·808	Empress of Burradale
College Flash	Queensland Agricultural High School and College, Gatton	7,180·94	293·441	Premier of Hillview
Honey 6th of Kingsdale	A. A. King, Mooloolah	6,878·15	276·94	Empress of Burradale
Princess 9th of Kingsdale	A. A. King, Mooloolah	6,384·45	243·453	Empress of Burradale

JERSEY.

Junior, 4 Years Old (under 4½ Years), Standard 310 lb.

orna of Oakview	F. J. Cox, Imbil	7,607·7	381·717	Acacia Crusader
Glenmah Victor's Maidenhair	F. A. Maher, Indooroopilly	6,305·82	327·433	Retford Victor's Noble

Junior, 3 Years Old (under 3½ Years), Standard 270 lb.

Glenmah Victor's Bracken	F. A. Maher, Indooroopilly	5,571·3	299·222	Retford Victor's Noble

Senior, 2 Years Old (over 2½ Years), Standard 250 lb.

Greenstock Buttercup	J. B. Keys, Gowrie Little Plains	6,781·4	391·453	Carnation's Lark's Baron

Junior, 2 Years Old (under 2½ Years), Standard 230 lb.

Faith of Peeramon	A. H. Koppen, Peeramon	7,369·45	372·748	Roseboy of Richmond
Glenview Lady May	F. P. Fowler and Sons, Coalstoun Lakes	5,362·6	327·94	Glenview Alfriston Duke
Bee of Inverlaw	R. J. Crawford, Kingaroy	6,203·95	325·619	Bruce of Inverlaw
Golden Rose of Golden Hill	C. Klaus, Mundubbera	5,055·25	303·36	Hero of Golden Hill
College Goldspray 2nd	Queensland Agricultural High School and College, Gatton	5,294·12	279·883	Burnside Renown
Glenview Primrose	F. P. Fowler and Sons, Coalstoun Lakes	4,365·75	273·198	Carlyle Larkspur 2nd Empire
Wyreene Rose Marie	J. B. Keys, Gowrie Little Plains	4,900·38	270·301	Lyndhurst Victor
Tot of Golden Hill	C. Klaus, Mundubbera	4,434·5	263·649	Pride's Hero of Burnleigh
Oxford Mabel II.	E. Burton and Sons, Wanora	4,036·91	251·409	Trinity Ambassador

AYRSHIRE.

Mature Cow (over 5 Years), Standard 350 lb.

Longlands Babette	Thos. Holmes, Yarranlea	9,405·15	372·011	Prince Roy of Fairview

FRIESIAN.

Junior, 3 Years Old (under 3½ Years), Standard 270 lb.

St. Athan's Gypsy 11th	W. H. Grams, Upper Tent Hill	8,372·54	323·234	General Dutch Oak

GUERNSEY.

Junior, 2 Years Old (under 2½ Years), Standard 230 lb.

Linwood Clarice	A. S. Cooke, Witta	5,541	262·3	Moongi Bright Boy

Answers to Correspondents.

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. Cyril T. White, F.L.S.

Honey Locust.

P.B. (Harlin)—

The specimen is *Gleditschia triacanthos*, the Honey Locust, a native of North America, but cultivated in many warm temperate countries. It is planted in Australia a good deal, and trees may often be seen on the Darling Downs. It belongs to the family Leguminosæ. The flowers are supposed to be very valuable honey producers, and the pods are eaten by stock. In the case of this tree some pods have probably been eaten and the seeds voided. The tree is deciduous and is easily grown from seed.

Mackie's Pest.

C.J.J. (Noumea, New Caledonia)—

The grass is *Chrysopogon aciculatus*, very common in North Queensland and looked on as rather a serious pest. It is commonly known as Grass Seed or Mackie's Pest. The seeds work through clothing and cause irritating sores. We have seen this grass as far south as Brisbane, but fortunately it does not seem to succeed in the southern parts of the State.

Guinea Grass.

G.W. (Mackay)—

The specimen is *Panicum maximum*, Guinea Grass, fairly common in Queensland, and indeed widely spread over most tropical and sub-tropical countries. It makes very good "chop-chop" for horses and other stock. Though it produces a large seed head, the percentage of infertile seed is usually fairly large. When once introduced in a locality, however, it seems to establish itself readily enough.

Flax (Climbing Buckwheat, *Linum*.)

F.E.J. (Pittsworth)—

The specimen with the blue flower is *Linum usitatissimum*, the ordinary flax or linseed. This is probably the cause of your trouble. The ordinary flax contains a prussic acid yielding glucoside which would probably affect sheep in the way you describe. The other plant like a convolvulus in habit is not one of the Convolvulus family, but is *Polygonum Convolvulus*, the Climbing Buckwheat, not known to be poisonous or harmful in any way. The black, triangular seeds which you received among the canary seed would belong to this plant. Your specimens of *Linum* have been passed on to the Agricultural Chemist for testing for a cyanophoric glucoside.

Calotropis Gigantea.

T.M. (Mareeba)—

The specimen is *Calotropis gigantea*, a native of India and Southern China. The bark contains a very strong fibre. So far as we know the sap has no value as a rubber, but the plant has reputed medicinal value among the Indians and Chinese. The plant is quite ornamental but might become a weed, and would probably be poisonous to stock as it belongs to a dangerous family, the Asclepiadaceæ. It is naturalised in some parts of the Gulf country, and we should think that once established would readily spread.

Milky Cotton Bush.

T.M. (Marmor)—

The specimens represent *Asclepias curassavica*, variously known as Milky Cotton Bush, Red Head, Wallflower Cotton Bush, Wild Oleander, &c. It is a native of the West Indies and tropical America, but is now a naturalised weed in most warm countries. It is poisonous to stock though, generally speaking, they do not eat it in sufficient quantities to cause trouble.

Shepherd's Purse.

O.J.S. (Thulimbah)—

The specimen is *Capsella Bursa-pastoris*, the Shepherd's Purse, a common European plant now naturalised as a weed in most warm temperate countries. It is very common in Queensland. A case has been recorded in New South Wales where young horses feeding on a cultivation paddock badly infested with this weed showed signs of colic, became bloated, and died. It was then found that they contained balls of fibrous material to the extent of nearly 50 per cent. of fibres from Shepherd's Purse, and death was due to simple mechanical obstruction of the bowel. No cases of trouble having been caused by the plant have come under our notice in Queensland, although this is a fairly common weed here.

Bird's Foot Trefoil ("Blackberry").

A.T.P. (Clermont)—

1. *Lotus australis*, Bird's Foot Trefoil. This plant belongs to the family Leguminosæ, and is a valuable fodder. It contains a prussic acid yielding glucoside, however, and if eaten in any great quantity, especially by hungry stock, death may ensue.

2. *Solanum nigrum*, called Blackberry in Queensland, but, of course, does not belong to the Blackberry family. It is sometimes called Deadly Nightshade. The ripe seeds are freely eaten by children, apparently without any ill-effects, but the green berries, we should say, would be decidedly poisonous. The plant belongs to a dangerous family, the Solanaceæ, which contains many poisonous plants.

Molasses Grass.

C.H. (Proston)—

The grass is not *Panicum muticum*, but *Melinis minutiflora*, Molasses Grass, a tropical grass now grown to some extent in Queensland, particularly in the more tropical parts of the State, such as the Daintree River. This grass has some reputation abroad, but our experience with it so far in Queensland has been that stock will not take to it unless driven to it by extreme hunger. Then they will eat it readily enough. When other food is available, however, they absolutely reject it. On the whole the grass is not one we could recommend for your district. The grass sets seed, but the seed is very light and small. *Panicum muticum* is a much better fodder, but it is very frost tender, and on the whole likes a rather moist climate. Kikuyu is another grass of similar habit, and is probably the best of the three for you to plant, although we think this should only be planted on an experimental scale.

Oxalis.

J.L. (Brisbane)—

We have had no experience with the use of sulphate of ammonia on oxalis, though we are inclined to believe it would simply blacken off the foliage and the bulbs would eventually recover. In South Australia, where an allied species of Oxalis is a very serious farm pest, it has been found that sodium chlorate sprayed on in solution—one pound of sodium chlorate to one gallon of water—has been effective. The weedicide, "Weedex," containing calcium chlorate, should be obtainable from most florists. In ordinary forking out, of course, care should be taken to see that the central bulb is obtained, and this should be removed as carefully as possible, especial care being taken to see that the little bulbils, all around the base of the leaves and at the top of the main bulb, do not fall off. Individual bulbs could perhaps be destroyed by applying to them, with the aid of an ordinary oil can, a few drops of crude carbolic acid. A few drops on a bulk, or a little sprinkle on a tuft, should entirely kill it. Ordinary kerosene might also be effective, though we have had no experience with it in oxalis eradication. These methods seem rather laborious, but there is no easy method of eradication.

Dog Weed.

F.McC. (Mundubbera)—

The specimen is *Verbesina encelioides*, the Dog Weed, a native of North America, now a common naturalised weed in New South Wales and Queensland. Dr. Seddon, of the Glenfield Veterinary Research Station, New South Wales, informed us recently in conversation that he had found this plant to be definitely poisonous to stock, though cases of poisoning by it are very rare. So far as we know the plant has not been declared a noxious weed for your shire.

Fumitory.

J.S.V. (Millmerran)—

The specimen is the Fumitory, *Fumaria officinalis*. The common Fumitory is a European weed, now naturalised in most warm temperate countries. It is generally regarded as poisonous to stock, but we have no very definite information regarding it. So far as we have observed stock seem to leave the plant untouched. It is a winter and a spring weed, and dies off at the approach of hot weather. Its eradication should not be a very difficult matter.

Tall Oat Grass.

T.H. (Ascot)—

The specimen is *Themeda avenacea*, the Tall Oat Grass. It may only be regarded as a second-rate pasture growth, though it produces a fair quantity of leafy growth, and both leaves and stems are generally regarded as nutritious. It is more adapted, we think, for cattle and large stock than for sheep. We should hardly think it worth while sowing for grazing purposes. The grass is also found in New South Wales. In a good growing summer season, particularly in Northern Queensland, it attains a great height, up to 7 or 8 feet. It has been grown experimentally under cultivation in New South Wales, and although it succeeded well it was apparently not thought sufficient of to proceed with.

Pepper Grass.

J.M.W. (Beaudesert Line)—

Your specimen is *Lepidium ruderale*, commonly known as Pepper Cress. It is one of the worst weeds we have for tainting milk, but apart from this it is quite a good fodder. It is one of those weeds commonly known in Queensland as Turnip Weed or Mustard Weed, names, however, applied in a very general way to members of the family Cruciferæ.

Prickly Poppy.

F.R.D. (Cloncurry)—

The specimen is *Argemone mexicana*, the Prickly Poppy, a very obnoxious weed which should be eradicated before it obtains a footing in a district. In Queensland, we think it is most abundant on the coast and on the Darling Downs. It is suspected of being poisonous to stock, but is rarely eaten by them. The only cases that have come under our notice have been where the plant has been cut, allowed to wilt, and the subsequent softened plant eaten by calves.

Khaki Grass.

J.H.A. (Southbrook)—

Some years ago experiments were carried out by Mr. F. B. Smith, then Assistant Agricultural Chemist, at Beaudesert, and he found that the khaki weed was easily destroyed by common salt, that is, butcher's salt or any waste salt, at the rate of one or two tons per acre. A weak arsenic solution was also found to be effective, but, of course, this spray is dangerous to use where stock are running. If you did not care to use an arsenical spray you could use a spray like "Weedex," which contains Calcium Chlorate. Though stock often graze without ill-effects in paddocks where weeds have been sprayed with this substance, care, of course, should be taken to see that stock are not allowed to get at tins containing the concentrate, or unused spray.

CROWN LAND FOR GRAZING SELECTION.

Marathon Resumption.

By courtesy of the Minister for Lands, Hon. Percy Pease, we are able to make the following announcements regarding grazing lands open for selection:—

Approval has been given for the opening for grazing homestead selection of the subdivisions of Marathon Resumption in the Hughenden district.

Five portions, ranging from 24,000 to 27,000 acres, will be opened at the Land Office, Richmond, on Thursday, 11th January, for a term of lease of twenty-eight years, at rentals ranging from 2d. to 2½d. per acre. The portions are situated from 13 to 18 miles south of Barabon Siding, and comprise good sound sheep country but not suitable for lambing purposes.

The portions comprise undulating downs, pebbly in places, and well grassed in normal seasons, with shade along the watercourses.

The blocks are well improved with bores and equipment, fencing, yards, and huts. The improvements on the blocks range from £1,000 to £2,300.

The selections will require to be stocked to a reasonable carrying capacity with the applicants' own sheep within a period of three years, and proof must be furnished of the financial standing and pastoral or land experience of the applicants.

Free lithographs and full particulars of these lands may be obtained from the Land Agents, Richmond and Hughenden; the Land Settlement Inquiry Office, Brisbane; and the Government Intelligence and Tourist Bureau, Sydney.

The Canmaroo Lands.

Approval has been obtained for the opening of a block of 22,000 acres in the parish of Canmaroo for prickly-pear development grazing homestead selection.

The block is suitable for both cattle and sheep, and will be available at the Land Office, Roma, on the 9th January next, for a term of lease of twenty-eight years, at an annual rental of ½d. per acre for the first fourteen years of the lease. The selection will be subject to the ring-barking of 8,000 acres and the provision of two permanent water improvements during the first eight years of the term.

A block of 62 square miles, known as Ungabilla block, will also be opened for pastoral development lease for a term of thirty years, at a rental of 15s. per square mile for the first twenty years of the lease.

The lessee will be required to ringbark 10,000 acres of the holding and provide three permanent water improvements during the first ten years, and to enclose the holding with a good and substantial fence during the first three years.

These blocks are situated about 15 miles south-westerly from Glenmorgan Railway Station.

Free lithographs and full particulars may be obtained from the Land Settlement Inquiry Office, Brisbane; the Land Agents, Roma, St. George, and Dalby; and the Government Intelligence and Tourist Bureau, Sydney.

General Notes.

Staff Changes and Appointments.

Mr. W. H. Yeo, of Victoria Point, and C. Heinemann, of Redland Bay, have been appointed Honorary Rangers under the Animals and Birds Acts.

Mr. W. J. McCurley, of Mount Glorious, has been appointed an Honorary Ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Messrs. F. Burow (Woongoolba, via Yatala), E. H. R. Fabian (Mount Cotton), M. E. Krebs (Woongoolba, via Yatala), and S. R. Black (Pimpama) have been appointed Honorary Inspectors under the Diseases in Plants Acts.

Messrs. K. R. Hack (Nerang) and J. Wilson (Hunchy) have been appointed Growers' Representatives on the Banana Industry Protection Board until the 30th September, 1934.

Mr. C. H. Defries has been appointed an Inspector under the Dairy, Stock, and Slaughtering Acts, Department of Agriculture and Stock.

Mr. D. A. Williams, Beaudesert, has been appointed an Honorary Ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Amended Definition of Peanut-Grower.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts amending the definition of a "peanut-grower."

The Order in Council constituting the Peanut Board provides that the persons entitled to vote at elections are those who have produced peanuts for sale within a given time. The amended definition provides that a grower shall be any person who during the twelve months immediately preceding any election or referendum has cultivated and grown peanuts for sale in any part of the State on not less than half an acre of land of which he is the owner or tenant, or who at the time of the election or referendum has growing not less than half an acre of peanuts for sale on land of which he is the owner or tenant.

Animals and Birds Sanctuary at Round Hill.

An Order in Council has been issued under the Animals and Birds Acts declaring the Reserve for Recreation and Captain Cook Memorial at Round Hill, near Miriam Vale, to be a sanctuary under and for the purposes of the abovementioned Acts.

It will now be unlawful for any person to take or kill any animal or bird on this sanctuary.

Broom Millet Board.

The election of two growers' representatives on the Broom Millet Board resulted as follows:—

	Votes.
Hans Niemeyer (Hatton Vale, Laidley)	50
Erich Max Schneider (Binjour Plateau, Gayndah) ..	44
Ernest Fred Hutley (Gurgeena, via Gayndah)	33
Thomas Martin Rasmussen (The Caves)	23

Messrs. Niemeyer and Schneider were the retiring members, and will now be reappointed for a further term of one year as from the 1st November.

Spraying of Deciduous Fruit Trees.

A new regulation under the Diseases in Plants Acts has received approval. It provides that every owner or occupier of an orchard in the Stanthorpe Fruit District shall cause his fruit trees to be sprayed once during the months of July or August every year to the satisfaction of an inspector, with one of the following approved insecticidal sprays:—

Miscible Oils.—One gallon of oil to 20 gallons of water.

Lime-Sulphur.—One and a-half gallons of a lime-sulphur concentrate registered under "*The Pest Destroyers Act of* 1923" to 10 gallons of water, and/or 1 gallon of 33 degrees Baume Lime-Sulphur Concentrate to 10 gallons of water.

Tar Distillate.—In the case of stone fruits, 1 gallon of tar distillate to 33 gallons of water. In the case of pip fruits, 1 gallon of tar distillate to 25 gallons of water.

Apple Levy.

A regulation has been issued under the Fruit Marketing Organisation Acts which rescinds the existing Apple Levy Regulations, and empowers the Committee of Direction of Fruit Marketing to make a levy on all fruitgrowers in the Stanthorpe area—that part within a radius of 40 miles from Wallangarra in which are situated the railway stations of Wallangarra to Dalveen, both inclusive, and Amiens to Fleurbaix, both inclusive.

The amount of the levy shall be 1d. per bushel case of apples grown and marketed from this district. When any apples are railed from any station in the district, the levy shall be computed at 3s. 4d. per ton (40 bushel cases or 80 half-bushel cases) and a proportionate part of 3s. 4d. for each fraction of a ton. Where more than one grower contributes apples to any consignment, the total amount of levy in respect thereof shall be paid by such growers in proportion to the respective weights of their contributions. A minimum of 1d. shall apply for any one consignment.

Every fruitgrower shall pay direct to the Committee of Direction the levy due by him before the fifteenth day of each month in respect of apples marketed during the preceding month. The provision is made, however, that fruitgrowers railing apples to any other destination than the Committee of Direction shall, at the time of railing, pay the levy to the Commissioner for Railways. Agents holding money to the credit of the fruitgrowers shall, if so required by the Committee of Direction, pay the levy to such Committee.

Every company or person carrying apples in such district for any market other than for railing from any station in the district, shall, on or before the fifth day of each month, furnish a return to the C.O.D. of all consignments carried during the preceding month.

The amounts received from the levy shall be used, firstly, for incidental costs, and secondly, the balance shall form part of the Apple Stabilisation Fund for the benefit of the Stanthorpe growers.

Better Boar Subsidy Scheme.

The better boar subsidy scheme now in operation offers exceptional opportunities for the farmer interested in the improvement of his pigs and in the development of a more extensive pork export market.

Following is a list of the centres to which better boars have been sent under the scheme up to the end of November, 1933:—

Western.—Dalby, Ipswich, Komine, Walloon, Square Top, Surat, Warwick, Gold Creek, Rosevale.

Northern.—Innisfail, Bambaroo, Ingham, Malanda.

South Burnett.—Tingoora, Murgon, Wondai, Cinnibar, Goomeri, Nanango.

Upper Burnett.—Abercorn, Mundubbera, Barajondo, Gayndah, Cannindah, Riverleigh, Biloela, Littlemore, Thangool.

North Coast.—Bauple, Eewah Vale, Widgee, Palmwoods, Maleny, Imbil, Mapleton, Kilcoy, Samsonvale, North Arm, Eumundi, Gunalda, Rockhampton, Garden Island, Gympie, North Maleny.

South Coast.—Rathdowney, Ormeau, Currumbin Creek, Springbrook, West Burleigh, Beenleigh, Gleneagle, Maroon.

As this is essentially an export trade scheme, subsidies are payable only on boars in those breeds specially recommended for the overseas trade—viz., Large Whites and Middle Whites. Boars over six months old only are eligible for subsidy.

Boars purchased under this scheme are subject to a 20 per cent. rebate in freight when transported over Queensland railways.

Sows of any age or breed are not eligible for subsidy or rail rebate.

The scheme permits of the farmer selecting the pig himself and then completing and submitting his application for subsidy, or requesting the Department to select and deliver the boar. In the latter alternative, applicants must ascertain the cost and pay in advance, the Department undertaking to estimate the total purchase price and make all arrangements for purchase and delivery as required.

When the applicant selects the boar himself, it is essential that he arrange with the District Stock or Dairy Inspector to inspect and complete a health declaration. These papers must also be certified to by a justice of the peace. When the Department purchases the stock, the officer attending to the purchase arranges all necessary papers in the presence of the vendor.

There are no unnecessary conditions, nor does the Department expect the farmer to incur a heavy outlay in the purchase of expensive animals.

The average price paid to date for selected animals is on a par with prices charged by stud pig breeders for breeds not included under this scheme, and no evidence is forthcoming of any excessive prices being charged or paid.

Each application is dealt with on its merits, and if applicants exercise care in preparing and submitting their papers, there should be no unnecessary delay in completing purchases. The decision to limit subsidy to boars in the two breeds mentioned—six months old or over—is in the interests of purchasers, and should entail no undue hardship on vendors.

The farmer must be prepared to accept the buying officer's purchases without claiming any refund, and must relieve the officer of responsibility, on the understanding that every care will be taken to ensure satisfaction to all concerned.

When stock are purchased in other States certain additional formalities are necessary, but these can be arranged. Transport expenses in these cases is much higher than in the case of Queensland purchases, and will be estimated by the officer purchasing stock.

All applications must be submitted on proper forms obtainable at the Department of Agriculture and Stock, Brisbane. All communications should be addressed to the Under Secretary.

Post Christmas Gifts and Greetings Early.

Our readers are reminded of the desirability of posting Christmas gifts and greetings early in order to assist the Postal Department and obviate possible disappointment to the public. During the twelve working days preceding last Christmas Day the Mail Branch at the Brisbane G.P.O. was called upon to handle 3,500,000 letters, 1,250,000 packets and newspapers, 42,000 registered articles, and 107,000 parcels, comprising the contents of 32,600 bags of mail.

The handling of such large numbers of articles naturally imposes a severe strain upon the resources of the department. Hence the exhortation to shop early, pack securely, address plainly, and post early. Packets may be marked, "Do not open until Christmas."

Christmas and New Year Greeting Telegrams.

The Post Office telegraph service has again made arrangements, from 19th December, 1933, to 7th January, 1934, for seasonal greeting telegrams during the forthcoming Christmas and New Year season to be issued to the addressee on a specially designed and coloured form, which will be enclosed in an attractive envelope.

No extra charge will be made by the department for this facility—the usual nominal rates will apply. All that is necessary for those who propose utilising the service is simply to write the greeting messages on the usual forms and lodge them at any telegraph office. Write the word "Greeting" at the top of each form. The messages can also be lodged by means of the phonogram service.

The greeting telegram should commend itself to the business man, as seasonal greetings by telegraph to customers build good will; they are sure to please, because telegrams are always warmly personal and reach the person for whom they are intended.

Each year the greeting telegram is becoming more popular, as is apparent from the increasing number lodged with the department each succeeding Christmas season, and special arrangements have been made by the Telegraph Department to dispose of a larger volume of this class of business rapidly and accurately during the forthcoming festive season.

The Telegraph Service will send telegrams to anyone, at any place and at any time. It makes no difference whether the telegram is to go one mile or 5,000 miles; clients will always receive the same unfailing courtesy, efficiency, and promptness in the treatment.

Specially reduced rates will also be in operation on cablegrams, radiograms, and beam wireless messages, lodged for transmission to other parts of the world. The rates may be obtained at any post office.

Rural Topics.

The Genetics of Jacob.

The reference made in the Legislative Assembly recently by the Minister for Agriculture and Stock (Mr. Frank W. Bulcock) to the genetics of Jacob would indicate that while genetics has only recently been regarded as a distinct branch of science, the foundations on which it rests are very old—in fact prehistorical. Human records, as far back as they go, provide evidence of a very early recognition of the principles of heredity, on which certain systems of selection in animal breeding were founded. To go no further back than the days of Jacob, we find that he devised a definite system of animal breeding and selection, by which he was able to beat even his wily old father-in-law. No doubt Jacob was in advance of his time, and he kept the secret of his success, so far as his contemporaries were concerned, to himself, for like many a modern cattle duffer who uses less scientific methods for acquiring stock he was purely selfish. In fact, his whole life was governed by the well-known formula: "Hang you, Jack, I'm all right!" If you had lived alongside of him you would certainly have watched your flocks by night, and would have taken no chances with newly dropped calves or unmarked lambs. He was what Australians call a "shrewd head," otherwise a consummate rogue; but that is no reason why we should do him an injustice on the score of his knowledge of stock and herd management.

The book of Genesis, which was quoted by Mr. Bulcock in reply to a question in Parliament, sets out in detail Jacob's system of influencing colour transmission in stock. The particular reference is Genesis xxx., 27-42, and that passage of Scripture is often cited to prove that Jacob believed in the efficacy of maternal impressions. A careful reading of the chapter shows that he realised the importance of segregation, as he put three days' journey between his own spotted and brindled mob and the flocks of Laban. The account of his methods has been given to us by one who was certainly an unbiassed observer, and who was not concerned with the material aspect. To get a clear understanding of Jacob's ideas on breeding, it is necessary to read the following chapter of Genesis—Genesis xxxi., 8-14—which purports to be Jacob's own account of the way he worked to windward of the old man. Here it is:—

> "If he (Laban) said thus: The speckled shall be thy wages, then all the cattle bare speckled; and if he said thus: The ring-straked shall be thy hire, then bare all the cattle ring-straked. Thus God hath taken away the cattle of your father and given them to me, and it came to pass at the time that the cattle conceived that I lifted up mine eyes, and saw in a dream, and behold the rams which leaped upon the cattle were ring straked and speckled and grizzled. And the angel of God spoke to me in a dream saying, 'Jacob,' and I answered, 'Here am I.' And he said, 'Lift up now thine eyes and see, all the rams which leap upon the cattle are ring-straked, speckled, and grizzled, for I have seen all that Laban doth unto thee.'"

Jacob had been well "stung" in his first contract with Laban. He had worked like a bullock in pole or pin for fourteen long years to make good his slip from grace, and had been struggling all that time to provide for his family. As a result of deep thinking while tailing his herds his "inspiration" came in a dream—Mixed breeding and isolation. Many a scientific man has found the solution of a difficult problem in the same way.

Taking the two chapters of Genesis together, Jacob had observed apparently the results of cross-breeding, and probably also observed what happened when both parents were of the same type. A genetic analysis of Laban's cattle is, of course, impossible, but if "ring-straked, speckled, and grizzled" are assumed to be dominant characters, it must be recognised that Jacob's breeding methods were not based altogether on superstition. He realised the value of isolation, and had some knowledge of the importance of giving the get an opportunity to develop under the most favourable conditions. Since the modern breeder makes use of the same principles, it indicates that the art of breeding was fairly well advanced at that early period.

The Pig's Nose—An Index of Health.

The nose of a pig is an index of his or her nature and condition. In the healthy pig the nose is moist, cool, and pink in colour. To the touch it is elastic. In disease it changes in appearance, becoming pallid or purplish, dry, hot, and rigid, or else flabby. Many an experienced breeder can tell at a glance the general condition of a pig from the condition of his nose. When pigs grow listless and seem to be dozing or sleeping more than usual, inspect their noses, and you are likely to find in them the indications of trouble.

The Feeding of Dairy Cows.

The following extracts are from a paper read by Mr. G. F. Shirley at the Illawarra District Conference, Agricultural Bureau of New South Wales:—

In the past we were content to convince ourselves that this food or that was good for producing milk, beef, or energy, and very rarely stopped to reason why. In much the same way we condemned certain rations as being "entirely unsatisfactory," or described certain tracts of country as being "no good for rearing cattle." In the feeding of cattle we have an almost unlimited number of facts which leave room for scientific investigation, and our present knowledge of feeding has been obtained from the accumulation of results disclosed by a great number of experiments.

The bodies of all animals are composed of sixteen main substances in varying proportions. These are as follows:—Water (oxygen and hydrogen), lime, iron, iodine, chlorine, manganese, potassium, phosphorus, sulphur, silicon, flurine, magnesium, carbon, sodium, as well as a few very small but important traces of copper, nickel, &c. There is now a special branch of sicence that has for its study the many ills—deficiency diseases they are called—that go hand in hand with the lack of one or more of these essentials.

It is important to note that most of the essential minerals can be present in nature in two forms, viz., organic and inorganic (that is to say, not organic), and it is the job of the vegetable kingdom to convert them from the inorganic form, which cannot be assimilated, into the organic form which can be readily digested. The great value of supplying minerals to your cattle in this way is the fact that the vegetable kingdom always supplies adequate quantities of digestives and vitamins for proper mineral assimilation. In a recent edition of that American paper, "Hoards Dairyman," a list was published showing the varied capacity of certain well-known crops to utilise certain mineral matter from the soils, the basis for comparison being an estimate of the average amount taken by each sort of crop from 1 acre of ground. The assimilation of lime for the growth of the several varieties was as follows:—

Oats, 102 lb. per acre.
Maize, 100 per acre.
Barley, 106 lb. per acre.
Lucerne, 405 lb. per acre.
Peas, 386 lb. per acre.

You will appreciate from the above the relative capacity of each of these plants to supply, among other things, that one essential—lime. Incidentally, the table gives us some idea of the amount of that particular substance that is required as a minimum for growth. As it is an established fact that, within certain limits, a cow never gives milk that is imperfect in its recipe, you will realise how important an abundant supply of all necessary essentials, in easily digestible form, can be.

In the marrow of her bones and in the fats of her body nature has provided the cow with a remarkable storehouse wherein she is able to stock away, in times when the right food is available, a concentrated supply of food and mineral matter upon which she can draw when times are lean, to convert into blood to nourish the tissues of her body, supply materials for the growth of her unborn calf, and later on supply it with milk. Although she can do this, it is evident that a cow that has to draw upon her reserves in this way for any length of time will be well below par and quite unable to do her best. Should this natural storehouse eventually run out and her foodstuffs still continue to lack any of the necessary essentials, she will invariably develop depraved tastes in an attempt to supply the want. If this deficiency should still continue, she will very soon dry herself right off. This trouble is rendered all the more serious in cases where the animal is young and there are the double requirements of growth and milk production to be supplied. We have all met the man who will tell us about some wonderful heifer that he had that "did remarkably well on her first or second calf but never did any good afterwards. He never seems to blame himself or the food for it.

November can be such a critical month for cows, not only because of the change of climate that it brings with it, but also because in this month we see the end to the spring urge to production. The cow is thrown back upon her own resources, or, rather, what resources she has left after robbing her bodily reserves to supply the extra spring production. That is why poorly fed cows drop in production so suddenly with the first really hot summer day.

Even with the most carefully thought out ration the mineral losses, particularly of lime and phosphorus, that are sustained by a heavy milking cow when at the peak of her production, are a serious problem, and one is rather inclined to believe that the milking capacity of our high-producing cows has been so increased by selective breeding that it considerably exceeds their capacity for mineral assimilation which, by the way, should be a still further argument for the adequate feeding of cows during the dry period in order to enable them to make good the losses that may have occurred. There are still, unfortunately, men who consider that the worst paddock on the place is "good enough for dry cows."

About twenty-seven years ago the theory of a balanced ration was hailed as a complete basis for scientific feeding, but when the wide differences of results obtainable from a variety of theoretically balanced rations were noted, it became apparent that the idea of balancing a ration did not go far enough, and the closer study of mineral structure of foodstuffs became necessary. Still closer study and experiment directed attention to the fact that the mere presence of all the mineral essentials in a food did not always crown the mixture with success. Theoretically perfect combinations were evolved, upon which, however, animals languished and died unless some milk or some green matter was added. It was the study of this "mysterious something" that permitted the assimilation of essentials, that first evolved the idea of vitamins.

Since the first discovery of the presence of vitamins we have learnt that there are many different kinds—each with a particular function of its own to aid in the assimilation of different kinds of substances. Thus we have a vitamin that aids the absorption of lime by the body; another that aids the absorption of fats, and so on. The most recent vitamin that has been discovered is one that has a very marked effect upon fertility and its application has had the effect of rendering many hitherto sterile animals fertile.

A cow that is on good Australian pasture will consume 110 to 120 lb. of grass per day, which would supply to her body about 23 lb. of dry matter and about 8 gallons of water. Provided the pasture contains a reasonable amount of mineral matter a cow fed on these pastures is being fed with enough material to make between 2 to 2½ gallons of milk per day according to the thriftiness of the animal. You will realise that upon ordinary good pasture of this kind, a cow that is giving over, say, 2 to 2½ gallons per day requires an extra amount of milk-making material to prevent her robbing her system. As she cannot eat any more grass, it stands to reason that if our breeders cannot supply us with a cow with a much larger stomach, then we must supply portion of her food in a more concentrated form.

In making up combinations of concentrates and roughages it is as well to remember there are, unfortunately, very few foods that alone are able to supply a full range of all necessary essentials, and therefore the most satisfactory rations must, of necessity, include in their make-up a fair variety of foods from different plants. Care should be taken to avoid choosing roughages and concentrates that are derived from "the one stalk," as, for instance, wheaten chaff and bran, corn silage and ground maize meal, green oats and ground oatmeal, &c., &c. The same idea can be extended to cover the undesirability of combining two substances that are deficient in the same essential such as, for instance, maize meal and bran, both of which are lacking in lime.

The same principles apply in the growing of crops and explain the remarkably superior results obtained from feeding a crop of oats that has been mixed with a certain percentage of legumes such as peas, vetches, tares, &c., in order to make up for the deficiencies in the composition of the oats, or say a crop of green maize that has been mixed with either soy beans or lucerne to correct the same defect.

From the foregoing you will appreciate the fact that the farmer who carefully studies the food combinations for his stock both in regard to minerals, vitamins, and concentrates will have a herd that, as well as being resistant to the usual inroads of stock diseases and troubles, will be able to produce milk to maximum capacity, economically, and of the highest quality that hereditary capability will allow.

Brine for Curing Pork or Beef.

One gallon water, 1½ lb. salt, ½ lb. brown sugar, ½ oz. potash. *Method.*—Boil and skim, then cool, when cold pour over the meat. The meat must be thoroughly cold and well sprinkled with crushed saltpetre to remove the surface blood. The above proportion to be used in making any quantity. Float a raw potato or an egg to test the strength of the brine.

Economical Poultry Feeding.

On present indications, writes the Poultry Expert of the New South Wales Department of Agriculture, it is apparent that poultry farmers are faced with one of the biggest crises ever experienced in the industry, as the average price of eggs is already lower this year than last, and prices are likely to remain lower during the remainder of the flush season, while it does not appear that there will be any substantial reduction in the cost of the main feeding stuffs. It is essential, therefore, that those dependent upon the industry for a living should do everything possible to effect economies without causing any reduction in egg production.

Those new to the industry may be tempted to reduce the food supply as soon as production commences to decline, but such a course would soon bring about a worse state of affairs, as the birds must have as much food as they require, and any attempt to cut down the ration would prove disastrous. In cases, however, where costly rations are being fed a reduction in cost of feeding may be effected by gradually changing over to a simple balanced ration such as is fed to the Hawkesbury Agricultural College egg-laying competition birds and those on the Department's poultry farms. This ration is as follows:—

Morning Mash.

	Lb.
Pollard	60
Bran	34
Meat meal	6
	100
Salt	22 oz.

Evening Feed.

	Lb.
Wheat	66
Cracked maize	34
	100

With regard to the evening feed, the proportion of maize can be reduced owing to its higher cost than wheat, and where sufficient green feed is not available lucerne chaff meal or dust could take the place of up to 15 per cent. of the bran without affecting the "balance" of the ration.

Should the price of wheat fall any lower wheat meal could probably be obtained or gristed on the farm at a cheaper rate than pollard or bran, in which case wheat meal could form up to 50 per cent. of the morning mash as follows:—

	Lb.
Wheat meal	50
Pollard	20
Bran	23
Meat meal	7
	100
Salt	22 oz.

Another means of reducing the cost of the morning mash would be to use rice pollard in place of wheat meal, the other ingredients being the same as in the above mash. The difficulty, of course, is that the supply of rice pollard would not be adequate to meet a heavy demand, and for this reason it would be perhaps preferable to use partly rice pollard and partly wheat meal in conjunction with bran and pollard as follows:—

	Lb.
Rice pollard	24
Wheat meal	24
Wheaten pollard	24
Bran	21
Meat meal	7
	100
Salt	22 oz.

Where an abundance of green feed such as lucerne or other crops which can be finely chaffed is available, 20 to 25 per cent. by weight could be used in place of that quantity of bran, but additional green feed may also be given later in the day. Any change decided upon should be made gradually, otherwise production may suffer.

Making White Hide.

1. Soak the hide in clean water for four hours, then run off the dirty water and cover with clean water; leave for twenty-four hours. This should be sufficient for fresh or salted hides. Dry hides should be soaked for a further twenty-four hours, or until they are soft.

2. Remove the hair by soaking hides in milk of lime—30 lb. lime per 100 gallons water. Handle each day, and leave until the hair can be removed—about six to seven days in summer.

3. Remove all flesh and fat by scraping with a knife. Wash well with several lots of water during the twenty-four hours after removing the hair and pieces of flesh, fat, &c.

4. Tan in a solution of alum (5 lb.), salt (1½ lb.), Glauber salt (1½ lb.), and water (10 gallons). Use enough of the solution to cover the hides. Handle twice daily and allow six days for tanning.

5. Drain well from the alum and salt solution, but do not wash; then cover both sides with fish oil or neatsfoot oil, and hang up and allow to dry slowly. Tanners have a machine for forcing the oil fats, &c., into the hide.

6. When dry, stretch until soft. If dry skins are difficult to stretch, sprinkle with water and cover for two days; again stretch and dry.

Alum-tanned leather is sometimes covered with a paste instead of oil before drying. The paste is made up as follows:—5 lb. flour, 2½ lb. alum, 1 lb. neatsfoot oil, 1 to 1½ gallons water.

Mix the alum and salt with water and then the flour and oil in a separate basin. Add to the flour and oil sufficient of the alum and salt solution to make a paste. Put the hide and paste into a tub, and handle the hide vigorously so as to force the paste into the leather. Hang the leather up and allow it to dry slowly without removing the paste. If the leather is too firm, rub on more fat, such as soft dripping, &c. If possible, stretch the leather just before it is quite dry. After stretching, it can be nailed on a wall or similar surface.—From directions issued by the Lecturer-in-Charge, Tanning School, Sydney Technical College.

Maize for the Dairy Farmer.

Though lucerne was usually termed the "king of fodders," said Mr. H. O. Cox, of Kangaroo Valley, in introducing his address on maize-growing at an Illawarra district farmers' conference, he was of the opinion that, for the dairy farmer, maize was really the crop which should be given that title. As a grain, it was unsurpassed as a concentrate that could be produced on the farm and stored till wanted, while if it was not required it could be sold and the money used to buy any other feed required. While lucerne could not be grown on some farms, every dairyman could grow maize.

To make a success of maize-growing the farmer must be an opportunist and carry out the cultural operations at the times best suited for them. Correct fallowing and tilling of the soil were half the battle. The deeper the ploughing, up to, say, 8 inches, the better, and it should be done early, say, at the end of May or in June, to retain the winter rains and expose the soil to the sweetening effects of the winter.

Wind and dry weather in spring would cause clodding, and to prevent this it was necessary to cultivate. Mr. Cox's practice was to apply 1 cwt. each of superphosphate and blood and bone in early August, and to disc harrow twice to cover the broadcasted fertilizer. A further disc harrowing was given in September to destroy weeds and then usually a light rolling. It has been found more economical to use the harrow than to plough a second time.

Seed selection work should be commenced in the paddock and attention given to type, disease freedom, yield, and maturity. Late maturing varieties were sown in rows 3 feet 4 inches apart with three seeds every 27 to 30 inches, a machine being used. Cultivation, consisting of the use of a springtooth cultivator and also a scuffler, ceased when the crop reached a height of 3 feet, since then the roots formed a network close to the surface and were damaged by the implements.

In conclusion, Mr. Cox emphasised the great value of the work being done in the Southern States by means of maize-growing competitions. Farmers were prone to overlook the national value of these competitions, though they realised their worth to the growers.

Points in Choosing a Dairy Sire.

Every farmer who is in quest of a really good dairy bull should first of all satisfy himself that the constitution is good, bearing in mind that a robust constitution is of greater importance to-day than ever it was, because of the greater demands on it.

The intending purchaser should then follow the pedigree as far back as it will take him, and examine closely the milk records of the bul's ancestors, if such are available. In the case of the crossbred animal it is impossible to do this, as his ancestors are usually unknown.

Having satisfied himself as to the constitution, blood pedigree, and pedigree of performance of his prospective purchase, the purchaser may then look more closely into the general qualifications of the bull.

A bull whose dam has a very unshapely udder should be avoided. A perfect udder hides a lot of faults in the conformation of the body, and gives an otherwise indifferent cow an attractive appearance.

The head of the bull is the first thing that attracts the eye. It should be distinctly masculine in appearance, virile yet placid, with a general expression that might be described with the words: "The whole world is mine."

Prominent eyes, broad forehead, and full nostrils are indications of great nerve force and strong constitution. The neck should be well developed and the throat clean. Other desirable points are: Deep, well-rounded body; rather flat, clean thighs; thin, curved flank, and well developed testicles. The skin should be soft and elastic, and have a yellow-tinged surface. The hair should be soft to the touch, and comparatively short; the legs flat and clean, and comparatively short. Some breeders place great value on the design of the bull's escutcheon, and maintain that it should be large, commencing at the forepart of the scrotum, and spreading well out on the thighs.

If an intending purchaser has the opportunity and the necessary cash, it is desirable to purchase a bull who has already proved himself to be a producer of dairy stock of the highest quality, and even if a long price has to be paid for such an animal, it will prove less costly in the end than to purchase a bull calf whose prepotency is an unknown quantity. With care, a middle-aged bull of good constitution will last a number of years. The energy of valuable bulls is often sapped by allowing them to run with the herd. They should be kept separate, and allowed to serve a cow once only. It is necessary to introduce new bulls from time to time, but a good sire should not be parted with as long as his services prove fruitful.

If we examine the history of the greatest cows in the various pure breeds, we will find that, in the great majority of cases, success has been attained by adhering to line breeding—that is, breeding within one family or strain; and there is no greater proof of this contention than the success of the world-famous Melba family of the Darbalara Estate, New South Wales. It is granted that success is not in every instance assured by breeding from sires and dams possessing the highest dairy qualities, and why it should not be so is somewhat of a mystery. Explanations have been given by various authorities, but they are not very convincing. It may be accepted, however, that the great majority of dairy cattle, so bred, always account for a continued improvement in the herd records. At first sight it is natural to conclude that the sire and dam which produced the great Melba XV. would continue to produce females of like dairy qualities, but it is not always so, though the improvement in the Melba strain was continuous.

When it comes to deciding as to which is the best breed of bull for using in a crossbred herd, there is great variance of opinion; but the majority of farmers will agree that the purebred bull of a well-known dairy strain is preferable to the mongrel who has neither blood pedigree nor pedigree of performance—Primrose McConnell, in "The New Zealand Farmer."

See the Land—Archbishop's Advice.

The greatest benefactor in Queensland would be the man who would turn the minds of the boys to the primary industries of the State, said Dr. J. Duhig, Archbishop of Brisbane, at the annual prize distribution at Nudgee College.

Education in the classroom was altogether too narrow, he continued. He thought it would be wise if students of secondary schools were given a fortnight's holiday at Easter to engage in specially organised excursions into the country districts, to see the working of the various primary industries. The boys knew very little of the vast natural wealth—including the mineral wealth—of Queensland.

Care of the Working Horse.

In most orchards the horse is the main source of power for drawing the various types of cultural implements used, and in order that such power shall be at its best (quite apart from the question of ordinary humanity), every care should be taken of the animal. Proper attention should be paid to his feeding and watering, grooming and stabling, or a satisfactory day's work cannot reasonably be expected.

Occasionally some discomfort is caused through want of thought. Some orchardists place a piece of hessian over the mouth of the horse during cultural operations to prevent his biting the trees as he passes along the rows. This hessian muzzle may prove very distressing to the animal, especially in hot weather, and the discomfort can be obviated or minimised by using coarse gauze or netting instead. The horse is then able to breathe more freely, even when labouring under a heavy load. Attention should also be paid to the harness, which should fit neatly, and steps should be taken to prevent any rubbing likely to result in painful sores. Special care should be taken in choosing a collar, as one that is too tight is very uncomfortable, while one that is too large is apt to chafe.

Cheese Taints from Tainted Milk.

It should be borne in mind that cheese is injured by taints, just as butter is. One of the greatest enemies of cheesemakers is the formation of gas in the vats, and one of the main causes of this evil is impure drinking water. Not only the cow's milk, but also her body, consists mainly of water, and when we realise this fact we can also realise that she must drink large quantities of water. If the water is impure it cannot be other than injurious to milk and its products.

Stagnant pools are undoubtedly one source of the trouble, not only because the water is more or less impure, but also because the cows carry a deal of mud, in both wet and dry form, into the milking shed. If at all possible, cows should drink from a running stream, or from troughs into which pure water is laid. The drinking troughs should be cleaned periodically, and a few handfuls of lime added to the water. A cow giving the enormous quantity of ten gallons milk, daily, must drink eight gallons to keep up her milk supply, and a considerable quantity besides to satisfy the demands of her body.

Early Maize Crops.

Early crops of maize which ripen in warm weather require to be harvested quickly in order to save loss from weevil in the field. There is, of course, a danger in harvesting this maize while too soft and storing it in a shed, as heating may develop which will favour further marked damage from weevil and moulds. Maize which is inclined to be soft or to contain excess moisture generally stores better if the husk is removed, and the removal of the husk in harvesting weevil-infested maize also has the effect of disturbing the weevils and shaking a large number free from the cobs, so that fewer weevils are taken into storage with the maize.

The best advice that can be given regarding such early harvested maize is to get it on to the market as quickly as possible, not attempting to hold it for feeding on the farm any longer than necessary, nor attempting to store it for a better price. In the first place, the price of maize from December or January to March or April is usually higher than it is later on in the winter or in spring. In addition to this, a loss in weight takes place from loss of moisture and from weevil damage, and in order to cut these losses it is far better business for the farmer to sell early harvested maize as soon as it can be shelled.

Fertilizing Pastures—A Profitable Practice.

The fertilizer treatment which gives the most economical results on the pastures at Berry Experiment Farm (South Coast, New South Wales) is half a ton lime every three years, 2 cwt. superphosphate every year, and also 2 cwt. sulphate of ammonia each year. With lime at £1 12s. per ton, superphosphate £5 per ton, and sulphate of ammonia £12 per ton, the cost of treatment works out at £2 per acre per year.

A comparison of the returns from the treated and untreated paddocks is interesting. An area in which the pastures were fertilized and properly managed produced at the rate of 219 lb. butter-fat per acre, which at 10s. per lb. works out at a return of £9 2s. 6d. per acre per year. An area which was not fertilized but on which the pastures were properly managed produced at the rate of 118 lb. butter-fat per acre at 10d. per lb., equalling a return of £4 18s. 4d. per acre per year, as compared with a return of only 25 lb. butter-fat at 10d. for £1 0s. 10d. per acre, from a paddock that was neither fertilized nor managed.

In addition to the improved return, the treated land is still better at the end of the season than the untreated land, and the cattle are improved in every respect for having grazed on the more nutritious pasture.

Points in Poultry Management.

While most poultry farmers endeavour to grow crops to provide a suitable supply of green feed for their birds all the year round, it frequently happens that, at times, through drought or lack of water in the summer months or the ravages of plant pests or diseases, green feed is not available.

The common belief of poultry farmers is that green feed is an additional foodstuff which exerts a beneficial effect on health and egg production, and that its temporary absence can be suffered without any great detriment to health.

Within recent years, however, it has been discovered that in green feed there is a substance, known as vitamin A, which is essential to the life of the birds, and that unless this substance is provided, a definite disease of the eyes, throat, gullet, and windpipe may result and cause severe mortality. The birds may show poor development, unthriftiness, lessened egg-production, leg-weakness, bad feathering and poor fertility and hatchability of their eggs.

This "green feed deficiency disease" has certain characters which might suggest an infectious disease, but it is definitely non-communicable and is caused by the deficiency of vitamin A, when green feed or other foodstuffs, such as cod liver oil and carrots, which contain this vitamin, are not included in the ration for several weeks.

That it is an economic proposition to supply vitamin A in some other substance than green feed when the latter is not available has been proved by the increased egg-production and the cessation of mortality that follows the feeding of such foodstuffs.

The treatment, therefore, consists of the immediate supply of the lacking vitamin, all fowls on the deficient diet being given either green feed, carrots, or cod-liver oil. By this means all sick fowls may be saved without any increase in the trouble, and rapid improvement of the whole flock is effected within seven days.

The obviously sick fowls should be treated individually, each bird being given, by means of a dropper, one-quarter of a teaspoonful of reliable cod-liver oil daily. Less seriously affected fowls and those not already showing symptoms should be given cod-liver oil at the rate of 4 per cent. in the mash for the first week, and thereafter at the rate of 2 per cent. The oil should be added daily to the mash, as oil-containing mashes lose in efficiency on keeping.

Green feed should be provided liberally again as soon as it is available, and this will ensure the prevention of the disease.—A. and P. Notes, New South Wales Department of Agriculture.

Silver Medals for Pigs.

Through the courtesy of the National Pig Breeders Association of England, the Australian Stud Pig Breeders' Society and the Royal National Association of Queensland have received advice of the donation of silver medals for the best boar and the best sow in each of the following breeds exhibited at the Royal National Exhibition in August, 1933—viz., Berkshires, Tamworths, Large Whites, Middle Whites, Wessex Saddlebacks.

The National Pig Breeders' Association in offering the medals are, in addition to fostering the interests of these important breeds, extending to Australian breeders similar priveleges to those enjoyed by British breeders of stud pigs. The donations will be of considerable value, and will be competed for by the principal breeders in the northern State.

Productive Pigs.

A world's record in weight for age from progeny of one sow in under two years is claimed for the Large White sow, Vaucluse Jewel 5th, a registered sow bred in Victoria, and from which a large number of stud stock have been selected. At twenty-six weeks her litters weighed—

First litter at twenty-six weeks weighed 2,400 lb.
Second litter at twenty-six weeks weighed 2,506 lb.
Third litter at twenty-six weeks weighed 2,375 lb.
Fourth litter at twenty-six weeks weighed 3,187 lb.

—a total litter weight of 10,468 lb. within two years. These pigs were produced and handled under official control, the figures being certified to by Victorian Government officers. The sow herself is a prominent prize winner of a very prolific and productive type.

Dry Salting a Pig.

The best months for curing a pig are May, June, July, August. After the pig has been cut in suitable pieces, remove the ham bone, insert a few holes in the thick part of the hams with a steel, and work some salt and saltpetre into the hole with the steel. Then rub the pieces well with coarse salt and stack them, flesh side up. After two days change the position, putting the bottom pieces at the top after rubbing with a mixture made up of the following:—3 lb. brown sugar, 7 lb. salt, 2 oz. saltpetre, 1 oz. allspice, 1 dessertspoon of carb. soda. This mixture will cure 1 cwt. of meat. Rub the pieces twice a week, each time changing the position. Leave the sides in a fortnight and the hams three weeks. Wash in luke-warm water and hang to dry, then smoke. Afterwards rub over with olive oil.

Size of the Red-backed Spider.

Mr. J. F. Dudley, of Camp Mountain, Dayboro' line, writes:—"There was an article in your Journal of September dealing with the red-backed spider. I should like to correct the statement that the spider's body is no bigger than a green pea. On a farm on the Warwick-Killarney road where I worked for a year or so some time back, my boss did not believe in killing them, as they are great fly-catchers, and so they had a free 'go.' I have seen dozens three times as big as peas—in fact, the smallest matured ones were bigger. Along the coast they are on the small side, but even here . . . you will repeatedly find them bigger than a pea."

Early Culling of the Poultry Flock.

While in normal times the matter of culling to any extent would not be considered until towards the end of December, the position is now such that no poultry farmer can afford to keep hens which are not capable of laying up to expectations for this time of the year. As a guide to the production that might reasonably be expected from a flock comprising half first-year and half second-year hens, the following table, based on a twelve-dozen eggs per hen per annum basis, may be helpful for checking up on the flock:—

	Eggs per hen.		Eggs per hen.
May	4	November	17
June	6	December	16
July	10	January	13
August	16	February	11
September	19	March	7
October	19	April	6

Anything in the nature of wholesale culling should not be undertaken (it should not be necessary on a well-managed farm), as this would only result in swamping the market and depressing prices. Moreover, in doing so, many hens which were only temporarily off laying would be sacrificed.

The best course to follow before deciding upon the number of birds which should be culled is to make a count of the hens in the various pens, and keep a record of the laying for a period of at least a week, and if the rate of production is much below that shown for the particular month in the above table, a close investigation should be made to find out if it is due to faulty management or to conditions which may be responsible for a temporary lull in laying. What is required is a judicious elimination of the hens which are not likely to continue laying throughout the rest of the flush season. This will include mainly those which are not sound in health nor of good physique and also those which have become coarse, both among the first and second year birds. In the good layer will be noted an alertness in appearance, clean face, fine skull, and prominent eye. The poor type shows the reverse, and although some birds of this class may be laying now they are not the sort that will continue, and nothing much will be lost by disposing of them, as they will bring more in the market now than after Christmas, unless, of course, low egg prices cause a rush to market of all and sundry hens which action cannot be too strongly deprecated.

The best plan for those who are not experienced in culling is to pick out all doubtful birds and place them in a small pen for a week, and if in that time only a few eggs are laid it can be taken that the poor layers have been selected. If, on the other hand, a large number of eggs is laid, it will be a matter of going through them again to ascertain which are laying, and it is here that the condition of the pelvic bones will assist. The layers will be found to have wide-apart pelvic bones and the abdomen will be full and soft, whereas those of the non-layers will be contracted.—A. and P. Notes, New South Wales Department of Agriculture.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable cases of infant mortality.

SUMMER SAFEGUARDS.

What queer delusions many people cherish! Many of our friends in the Southern States still imagine that the Queensland summer is hotter than their own, although the temperature records every year rise higher in Melbourne and Adelaide than in the greater part of this State. Even in Sydney it is not realised that every February they enjoy the same moist heat as we do on the Queensland coast. Our summer lasts longer—that is the only difference.

So far as infants and young children are concerned our summer heat is perfectly harmless. It is not summer heat, but summer diseases that are to be feared. Those diseases that render most tropical countries unsuitable for permanent occupation by white races are here fortunately absent, or if not absent easily controllable. Malaria exists only in a few localities and in a mild form. Hookworm also is strictly limited in its area and is easily controlled by simple sanitary precautions. The diarrhœal infections, which used to cause such heavy mortality among infants in the summer all over the world, are here no longer a frequent cause of death. By breast feeding, by greater care in the preparation of food, in the sterilisation of utensils by boiling, and by the exclusion of flies, the diarrhœal mortality has been reduced to a very low rate.

We must not relax these precautions. Diarrhœa still threatens us every summer, and if we are not careful will enfeeble or kill our babies as surely as it used to do twenty or thirty years ago. An intelligent understanding of its causes is the first condition necessary for their safety.

Diarrhœa is the result of something irritating in the bowel, which it is trying to get rid of. This something is either more food than can be digested and absorbed, unsuitable and irritating food, or quantities of infectious bacteria. For practical purposes we may distinguish food diarrhœas from infectious diarrhœas, remembering that the distinction is not always clearcut.

Food Diarrhœas.

In hot weather we need more water to drink and less food to eat. This is true of babies as well as other people. We need less fuel to maintain bodily heat. Mothers sometimes fail to distinguish between hunger and thirst in babies, and yet it is easy. Thirst is satisfied by plain water. Milk is a food, and thirst may induce an infant to take too much of it when he is not hungry.

We do not wean babies during the hot weather if we can avoid it. The breast-fed babe is much safer than the babe artificially fed. We do not try experiments with new sorts of food at this time or, at least, we try them very cautiously. We are very careful of our milk supply. If the milk is not clean to begin with (not an uncommon occurrence), or if it is kept too long in hot weather, great numbers of bacteria grow in it. These may be killed by boiling, but that does not make the milk clean and fresh. Stale and dirty milk is a common cause of loose motions.

The treatment of food diarrhœas is very simple. Give a teaspoonful of castor oil to clear out the bowels. Stop all milk and other foods. Give nothing but very thin barley water slightly sweetened or plain water, until the motions begin to improve. Then give whey made with junket tablets. Babies over nine months

may have water-arrowroot, water-sago, or if they have teeth a small finger of bread baked hard in the oven. Do not give milk until the motions are much better, and then in small quantities to begin with.

Infectious Diarrhœas.

Usually the infant is very ill at the beginning. Sometimes the disease is deceitfully mild at first, but does not improve with simple treatment. For these cases medical advice should be sought at once. Especially is this necessary when the passage of blood and slime with straining shows that it is a case of dysentery.

The prevention of infectious diarrhœa is the mother's responsibility. The milk must be either boiled or pasteurised. The milk jugs should be scalded. The bottles and teats must be carefully cleaned and boiled. All must be most carefully screened from flies, which carry the infection from house to house. The baby that sucks a dummy, whether breast-fed or bottle-fed, is in danger of infection from flies. The only safeguard is to burn the dummy.

DIETETIC VALUE OF FRUIT.

Following is an extract from a special article in "The Farmer" (Pietermaritzburg, Natal, South Africa), by Dr. Redvers J. Blatt, B.Sc., Ph.D.

THIRTY years ago everything revolved round proteins, carbohydrates, fats, and ash (mineral salts). Interest in proteins exceeded all else, since without protein life is impossible. We find, however, that other things, such as iron, iodine, and vitamins are equally necessary.

At that time we were led to believe that any food containing proteins, carbohydrates, fats, ash, and water in appropriate portions was a satisfactory and complete food. No mention was made of other substances which in the most minute quantities are necessary, such as iron, mercury, manganese, and molybdenum (a chromium), and which act as catalysts (or something to hasten a reaction although not taking part in it).

To-day there is a tendency to ascribe certain diseases to lack of vitamins, while lack of iodine in the diet is regarded as being responsible for a specific disease.

Caloric Value.

Food values are frequently expressed in terms of calories. A calory is the amount of heat necessary to raise a litre of water 1 degree centigrade or a pound of water 4 degrees Fahr. In general terms it may be stated that a healthy man weighing 150 lb. in a temperate climate, and in the performance of ordinary work, requires daily a food equivalent of approximately 3,000 calories. While it is true that the real value of any food is not always represented by the heat units or calories, at the same time the total food value is so indicated. The value of a food as a source of energy varies directly with its caloric value.

Dietetic Value.

Protein foods are more adapted to the development of tissue than to the quick production of heat. On the other hand, carbohydrates are less tissue-forming substances, but are incomparably more effective in supplying the heat-giving materials. In a crude way we might say that the proteins are the foods which make good the losses due to wear and tear in the machinery of the body, while the carbohydrates are the foods which keep the machinery in motion and do work.

The ash consists of various minerals, all of which serve useful purposes in the body economy. While only relatively small quantities are necessary, they are essential to the body needs. Fruits and green vegetables contain appreciable quantities of these valuable mineral salts, consisting chiefly of the phosphates, sulphates and Chlorides of potash, soda, magnesia, and lime, as well as significant amounts of iron. These salts are present in fruits and green vegetables, mainly as base-forming minerals, while in some other foods they are mainly present in an acid-forming condition.

Vitamins.

In the first decade of the present century, when food values began to be studied by animal experimentation, it became evident that something more than mere calculated amounts of protein, carbohydrate, fat, and salts was required to support life, promote growth, and ward off disease.

In 1910 Funk called attention to "a group of indispensable complexes" which he named "vitamins." It was not until 1915, however, that the importance of the discovery was realised. Funk's work furnished a key to the existing confusion and seeming contradiction in experimental results.

What are vitamins? Vitamins, also known as "accessory factors," are somewhat difficult to explain. We know more about their reactions and uses than about their composition. While it is important that the proper balance of carbohydrates, protein, fat, and mineral salts be adhered to, other essential vitamins must be provided if health is to be maintained.

Six Known Vitamins.

Research workers, particularly Rosenheim, Wendaus, Webster, and Hess, have learned much about vitamins. According to their work it is more than likely that vitamins will soon be isolated and artificially manufactured.

The vitamins are named after the letters of the alphabet. Vitamin A is found in most animal fats, such as butter, milk, cheese, beef or mutton fat, green vegetables and fruit, and all vegetables of a yellow colour. Vitamin A is called the anti-rachitic or anti-ophthalmic vitamin, and has not been isolated yet. Its chemical nature is quite unknown. If it is absent in the diet, growth ceases and the body becomes highly susceptible to colds, influenza, pneumonia, tuberculosis, and rickets; also the eyes become ulcerated.

Vitamin B is the anti-neuritic, anti-beri-beri, or water-soluble vitamin, and is characteristically present in the seeds of plants and the eggs of animals. Cereals, comprising the whole grain, are rich in Vitamin B. It is associated with the husks (bran) of yellow but not white mealies, with very many fruits, vegetables, and with yeast. It protects the nervous system, hence is called the anti-neuritic vitamin. If Vitamin B is withheld from the diet, paralysis or beri-beri is the result. In the Orient, where polished rice is consumed regularly, beri-beri is a common complaint.

Anti-Scorbutic.

Vitamin C is the anti-scorbutic vitamin, sometimes called water-soluble C, and is present in varying quantity in fruits, vegetables, green leaves, and in living or freshly killed animal tissues. The citrus fruits—viz., orange, lemon, and grape-fruit—are particularly rich in Vitamin C, which is probably present in all living turgid cells, whether of animal or vegetable tissues.

Vitamin D we know quite a lot about. It occurs in most plant and animal sterols, being formed by ultra-violet rays upon ergosterol (the sterol of ergot and yeast). It manufactures bone from gristle, and thus prevents rickets in children. This is the only vitamin the chemical nature of which is known. The other vitamins have not yet been isolated.

Vitamin E, first known as Vitamin X, has only recently been discovered. Vitamins A and B, even in liberal diets, give rise to sterility if Vitamin E is absent, both males and females being affected. The richest source of Vitamin E is the oil of the wheat germ, a daily dosage of 250 milligrams being sufficient to prevent sterility in rats. Vitamin E is also found in oats, corn, coconuts, olives, cotton-seed oil, egg yolk, and lettuce.

Recently another vitamin, named G, has been discovered. It appears to have an effect on growth and in maintaining a healthy condition of the skin and mucous membrane of the mouth.

It must be remembered that vitamins are not foods, but catalysts essential in maintaining health. They react on the other constituents of foods, proteins, &c., but themselves are useless. Without them food is useless.

Vitamins in Fruit.

As far as vitamins are concerned, fruit, in general, is most valuable. Fruit is a great source of Vitamins A, B, and C, and even Vitamin E, since olives contain this vitamin. There are, however, certain fruits which are far more valuable than others—namely, banana, citrus fruits, and the avocado—if general utility is taken into consideration.

Citrus fruits are probably the greatest source of vitamins. It has been demonstrated by many research workers that oranges, lemons, and grapefruit contain Vitamins A, B, and C. The pre-eminent value of citrus fruits as a preventive and curative of scurvy, whether latent or declared, should lead eventually to these fruits being regarded not as a luxury but as a necessity for the maintenance of health.

Minerals.

It is a known fact that phosphorus is widely distributed in the body, and is essential to the living cells, as are the proteins, while calcium and iron are necessary for the development of bone and blood. Bananas, apples, and oranges contain appreciable quantities of phosphorus, calcium, and iron. The onion, like most green vegetables, is of value in the diet chiefly for the mineral salts which it contains. When vegetables are unusually costly there is a danger that the health of the community may suffer from a deficiency of base-forming minerals in the diet. It is important, therefore, to call attention to the fact that apples, bananas, and oranges may be used as substitutes for vegetables. They contain the same mineral matters in varying proportions.

Fats.

The laxative properties of most fruits depend on the stimulating effects of the fibre in the wall of the intestine, and partly on the organic acids and minerals. The avocado should perhaps prove to have laxative qualities of a peculiar type, possessing as it does the combination of the usual fruit principles and that of fat or oil, which has a tendency to soothe and to lubricate the intestine even while it acts as a mild laxative. The avocado is a natural combination of these two types of foods—as if fruit and olive oil had been chemically combined by Nature. As far as fat is concerned, the olive and the avocado are the most important. The fat content of the avocado varies from 10 to 31 per cent., and that of the olive from 20 to 28 per cent.

In addition to the citrus fruits the banana and avocado are two outstanding fruits.

The Banana.

The banana is a delicacy, but also an important and substantial food. In food value it ranks highest among all fresh fruits, and surpasses most of the vegetables. Apples, pears, peaches, melons, and berries are nearly nine-tenths water, whereas the banana is one-fourth solids. The banana is a staple food, and in the tropics it takes the place of potatoes and cereals. The banana is essentially a carbohydrate food, but is valuable also for its minerals. The banana, when ripe, is one of the easiest foods to digest in the whole dietary, and reaches the consumer in a germ-proof package.

The Avocado.

The avocado contains twice as much mineral matter as that yielded by any other fruit, and as far as protein in fresh fruits is concerned, the avocado stands in the lead. The total dry matter in the avocado is greater than that noted for any other fresh fruit.

"AN ORANGE A DAY."

According to reports of the autumn session of the Middlesex Hospitals Medical School, the saying that "an apple a day keeps the doctor away" is due to be superseded by the saying "An orange a day keeps the doctor away."

"The apple is a most delightful fruit," said Professor V. H. Mottram, Professor of Physiology of the University of London, and an authority on foods, "yet it is only a sweetmeat and is negligible as nourishment or as a medicine. On the other hand, the orange is most valuable as nourishment, and medicinally. It is anti-scorbutic, and rich in the vitamin contained in sunlight. It also has calcium, which is essential to bone-building. Recent experiments indicate that oranges are nearly the equal of milk in nourishment."

FOOD VALUE OF BANANAS.

When it is considered that the banana is an article of diet in every country of the world, and that the inhabitants of some portions of the globe subsist on it almost entirely, it is strange to find some people under the impression that bananas should be eaten sparingly and only by people with good digestion, runs the introduction to the banana recipe booklet issued by the Commonwealth Banana Committee.

It is true that the banana, eaten in an *unripe* state, will, in common with all fruits, cause intestinal disturbance to a greater or less degree. The *ripe banana*, however, is not only a fruit of remarkably high food value, but is amazingly easy to digest. It can be eaten with safety and relish by everyone from infancy onwards.

No fruit compares with the ripe banana in food values; no fruit approaches it in regard to digestibility and easy assimilation; no fruit and very few foodstuffs approach it in regard to value for money expended. Writing of the banana, Professor S. C. Prescott (Massachusetts Institute of Technology) says: "The ripe banana contains all the classes of food materials required for the human body. Although the amounts of protein and fat are slightly too low to constitute a perfectly balanced ration, the combination of bananas with milk, or its utilisation to supplement a diet containing a small amount of meat will produce a ration which is ample to take care of the body needs."

SUMMER SALADS.

Following are some recipes given by Miss Bowden in an address on "Commonsense in Summer Meal Preparation," at a meeting of a branch of the Agricultural Bureau of New South Wales:—

Tomatoes with chopped parsley and young onions.

Tomatoes (small) peeled and quartered, with diced cucumber, pieces of cheese, hearts of lettuce, moulded spinach, diced beetroot, and sliced egg.

Asparagus tips, chopped tomato, and broken cauliflower.

Diced beetroot with watercress, shredded cabbage or lettuce, cauliflower separated into flowerets with quartered hard-boiled eggs.

Diced cold boiled potatoes, finely-chopped onion, chopped celery, salt.

Cucumbers cut lengthwise and steamed until tender. Scoop out the seeds and fill with prawns or lobster mixed with mayonnaise. Serve these cucumber boats on lettuce. Decorate with whole prawns and sliced olives.

Red Heart Salad.—Set tomato jelly in a shallow pan and cut with a heart-shaped pastry cutter, arrange with hearts of lettuce.

Artichokes cooked and quartered served with thinly-sliced oranges and chopped celery.

Stuffed Beets.—Scoop out the centre and fill with chopped cucumber, radishes, celery, and olives mixed with dressing.

Stuffed Tomatoes.—Scoop out the centre and fill with chopped tomato pulp, diced cucumber, salt, pepper, a little grated horse-radish and dressing, or chopped tomato, celery, raisins or sultanas, a very little green onion, a finely chopped sour apple, and dressing.

Chopped tomato, cucumber, cooked sweet bread (any white meat may be used instead), salt, pepper, capers, with dressing.

A Way of Serving Tomatoes.—Cut in halves and put together again with a layer of cream cheese, seasoned and moistened with salad dressing. Top with a sprig of parsley.

Banana, beetroot, cucumber, grated nut, and lettuce.

Orange, tomato, beetroot in mayonnaise jelly; serve on lettuce.

Pineapple, tomato, cheese in mayonnaise jelly; serve on lettuce.

Apple, celery, parsley, walnut, on lettuce.

Beetroot and green peas in mint jelly.

Combination Salad.—Tomato wedges, sliced cucumber, onion rings; sprinkle with vinegar and let stand for some hours; serve on lettuce with French dressing.

Green Vegetable Salad.—Cooked string beans and peas, diced cucumber, minced onion; sprinkle with vinegar and let stand for some hours; serve on lettuce with French dressing.

Chiffonade Salad.—Cubes of cooked beetroot, sliced hard-boiled eggs, minced onion; sprinkle with vinegar and let stand for some hours; serve on lettuce with mayonnaise.

Carrot and Cabbage Slaw.—New carrots, cut in long fine strips; cabbage finely shredded mixed with vinegar; combine carrots and cabbage by tossing together lightly with salad dressing; serve thoroughly chilled.

Golden Glow Salad.—Diced pineapple, grated raw carrot, grated nut; on lettuce with mayonnaise.

Other Salads.—Macaroni, salmon, sliced egg and minced onion; served on lettuce.

Baked apples, served with nuts and raisins on lettuce, garnished with currant jelly and mayonnaise.

Grapefruit and orange sections arranged on lettuce with fine strips of dates and figs; dressing.

Celery, cheese, and pineapple on lettuce; serve with dressing.

Pears and Asparagus Salad.—Half a pear for each serving; four or five asparagus tips, salt and pepper, and dressing; serve on lettuce.

Jellied Mayonnaise.—Any salad vegetables may be set in mayonnaise jelly, the receipe for which is as follows:—

Ingredients.

3 teaspoons gelatine.
3 tablespoons condensed milk.
2 dessertspoons vinegar.
1 egg (hard-boiled).
¼ teaspoon mustard.
1 teaspoon sugar.
½ teaspoon salt.
½ cup hot water.

Method.

Crush yolk of egg and sugar together in a basin, add mustard, salt, pepper, vinegar, and milk. Mix all thoroughly together. Dissolve gelatine in hot water, add to other liquid and blend. Pour on to prepared salad ingredients.

POISON IN PAINT—DANGER TO CHILDREN.

Lead-poisoning is by far the most common cause of the frequency of nephritis in Queensland, in the opinion of Dr. L. J. Jarvis Nye, of Brisbane, who, in "Chronic Nephritis and Lead-poisoning," a book just published by Angus and Robertson Ltd., of Sydney, urges the complete prohibition by law of the use of lead paint.

Dr. Nye gives figures to show that the increased death rate from chronic nephritis among young people in Queensland is a tragic reality, presenting an important field for research. Since 1928 he has been able to produce evidence that lead-poisoning in childhood has played an important part in causing the increased mortality.

"Of 87 patients questioned by me 71 said the paint on the verandas of houses occupied by them in their childhood was dry and powdery," he writes. "Forty-six were nail-biters or thumb-suckers, and in seven cases the parents said the child had been in the habit of licking the rain-drops from the veranda railings. Obviously the majority had been exposed to the risk of lead-poisoning."

Dr. Nye finds no support for suggestions that the frequency of nephritis in Queensland is traceable in any considerable degree to chronic tonsillar infection, syphilis, measles, diphtheria, malaria, or filaria, or to climatic conditions.

Investigating the possible sources of lead-poisoning, he dismisses the theory that the town water supply might be responsible to some extent, and comes to the conclusion that the most likely source is the paint on the walls of the houses and on the railings of the verandas. He attributes the lessening of the incidence of plumbism in Queensland to the education of the public on the subject, the legislative prohibition of the use of lead paint on veranda railings, the earlier recognition and treatment of cases by medical men, improved hygiene in the home and at school, the work of the Creche and Kindergarten Society, a change in the type of houses, and the introduction of an enormous number of non-poisonous paints.

Farm Notes for January.

FIELD.—The main business of the field during this month will be ploughing and preparing the land for the potato and other future crops, and keeping all growing crops clean. Great care must be exercised in the selection of seed potatoes to ensure their not being affected by the Irish blight. Never allow weeds to seed. This may be unavoidable in the event of long-continued heavy rains, but every effort should be made to prevent the weeds coming to maturity. A little maize may still be sown for a late crop. Sow sorghum, imphee, Cape barley, vetches, panicum, teosinte, rye, and cowpeas. In some very early localities potatoes may be sown, but there is considerable risk in sowing during this month, and it may be looked upon merely as an experiment. Plant potatoes whole. Early-sown cotton will be in bloom.

On coastal and intercoastal scrub districts, where recently burnt-off scrub lands are ready for the reception of seed of summer-growing grasses, sowing may commence as soon as suitable weather is experienced. Much disappointment may be saved, and subsequent expenditure obviated, by ensuring that only good germinable grass seed is sown, of kinds and in quantities to suit local conditions, the circumstances being kept in mind that a good stand of grass is the principal factor in keeping down weeds and undergrowth.

In all districts where wheat, barley, oats, canary seed, and similar crops have recently been harvested, the practice of breaking up the surface soil on the cropped areas should invariably be adopted. Soil put into fit condition in this way will "trap" moisture and admit of the rains percolating into the subsoil, where the moisture necessary for the production of a succeeding crop can be held, provided attention is given to the maintenance of a surface mulch, and to the removal, by regular cultivation, of volunteer growths of all kinds. If not already seen to, all harvesting machinery should be put under cover, overhauled, and the woodwork painted where required.

Where maize and all summer-growing "hoed" crops are not too far advanced for the purpose, they should be kept in a well-cultivated condition with the horse hoe. Young maize and sorghum crops will derive much benefit by harrowing them, in the same direction as the rows are running, using light lever harrows with the tines set back at an angle to obviate dragging out of plants, but the work should not be done in the heat of the day.

Quick-maturing varieties of maize and sorghum may still be sown in the early part of the month in coastal areas where early frosts are not expected.

Succession sowings may be made of a number of quick-growing summer fodder crops—Sudan grass, Japanese and French millet, white panicum, and liberty millet (panicum). In favourable situations, both "grain" and "saccharine" sorghums may still be grown; also maize, for fodder purposes.

Fodder conservation should be the aim of everyone who derives a living from stock, particularly the dairyman; the present is an important period to plan cropping arrangements. Exclusive of the main crops for feeding-off (when fodder is suitable for this purpose), ample provision should be made for ensilage crops to be conserved in silo or stack. As natural and summer-growing artificial grasses may be expected to lose some of their succulence in autumn, and more of it in winter and early spring, the cropping "lay-out" to provide a continuity of succulent green fodder throughout the season calls for thorough and deep cultivation and the building up of the fertility and moisture-holding capacity of the soil. Planter's friend (sorghum) may be sown as a broadcast crop at the latter end of the month for cutting and feeding to cattle in the autumn and early winter. Strips of land should be prepared also for a succession sowing about the second week in February, and for winter-growing fodder crops.

Orchard Notes for January.

THE COASTAL DISTRICTS.

ALL orchards, plantations, and vineyards should be kept well cultivated and free from weed growth; in the first place, to conserve the moisture in the soil, so necessary for the proper development of all fruit trees and vines; and, secondly, to have any weed growth well in hand before the regular wet season commences. This advice is especially applicable to citrus orchards, which frequently suffer from lack of moisture at this period of the year if the weather is at all dry, and the young crop of fruit on the trees is injured to a greater or less extent in consequence.

Pineapple plantations must also be kept well worked and free from weeds, as when the harvesting of the main summer crop takes place later on, there is little time to devote to cultivation. If this important work has been neglected, not only does the actual crop of fruit on the plants suffer, but the plants themselves receive a setback.

Banana plantations should be kept well worked, and where the soil is likely to wash badly, or there is a deficiency of humus, a green crop for manuring may be planted. Should the normal wet season set in, it will then soon cover the ground without injury to the banana plants. When necessary, banana plantations should be manured now, using a complete manure rich in potash and nitrogen. Pineapples may also be manured, using a composition rich in potash and nitrogen, but containing no acid phosphate (superphosphate) and only a small percentage of bonemeal, ground phosphatic rock, or other material containing phosphoric acid in a slowly available form.

Bananas and pineapples may still be planted, though it is somewhat late for the former in the more southern parts of the State. Keep a good lookout for pests of all kinds, such as Maori on citrus trees, scale insects of all kinds, all leaf-eating insects, borers, and fungus pests generally, using the remedies recommended in Departmental publications.

Fruit fly should receive special attention, and on no account should infested fruit of any kind be allowed to lie about on the ground to become the means of breeding this serious pest. If this is neglected, when the main mango crop in the South and the early ripening citrus fruits are ready, there will be an army of flies waiting to destroy them.

Be very careful in handling and marketing of all kinds of fruit, as it soon spoils in hot weather, even when given the most careful treatment. Further, as during January there is generally more or less of a glut of fresh fruit, only the best will meet with a ready sale at a satisfactory price.

Grapes are in full season, and in order that they may be sold to advantage they must be very carefully handled, graded, and packed, as their value depends very much on the condition in which they reach the market and open up for sale. Well-coloured fruit, with the bloom on and without a blemish, always sells well, whereas badly coloured, immature, or bruised fruit is hard to quit.

One of the greatest mistakes in marketing grapes is to send the fruit to market before it is properly ripe, and there is no better way to spoil its sale than to try and force it on the general public when it is sour and unfit to eat.

Bananas for sending to the Southern States require to be cut on the green side, but not when they are so immature as to be only partially filled. The fruit must be well filled but show no sign of ripening; it must be carefully graded and packed and the cases marked in accordance with the regulations under the Fruit Cases Acts and forwarded to its destination with as little delay as possible.

Pineapples should be packed when they are fully developed, which means that they contain sufficient sugar to enable the fruit to mature properly. Immature fruit must not be marketed, and if an attempt is made to do so the fruit is liable to seizure and the sender of the fruit to prosecution under the abovenamed regulations. Further, the fruit must be graded to size and the number of fruit contained in a case must be marked thereon. Immature fruit must not be sent. For canning, the fruit should be partly coloured; immature fruit is useless; and overripe fruit is just as bad. The former is deficient in colour and flavour and the latter is "winey" and of poor texture, so that it will not stand the necessary preparation and cooking.

Should there be a glut of bananas, growers are advised to try and convert any thoroughly ripe fruit into banana figs.

The fruit must be thoroughly ripe, so that it will peel easily, and it should be laid in a single layer on wooden trays and placed in the sun to dry. If the weather is settled, there is little trouble, but if there is any sign of rain the trays must be stacked till the weather is again fine, and the top of the stack protected from the rain. To facilitate drying, the fruit may be cut in half lengthways. It should be dried till a small portion rubbed between the finger and thumb shows no sign of moisture. It can be placed in a suitable box to sweat for a few days, after which it can be dipped in boiling water to destroy any moth or insect eggs that may have been laid on it during the process of drying and sweating. It is then placed in the sun to dry off any moisture, and when quite dry it should be at once packed into boxes lined with clean white paper. It must be firmly packed, when, if it has been properly dried, it will keep a considerable time. It can be used in many ways, and forms an excellent substitute for raisins, sultanas, currants, or other dried fruits used in making fruit cakes and other comestibles. Banana figs will be found useful for home consumption, and it is possible that a trade may be built up that will absorb a quantity of fruit that would otherwise go to waste.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

JANUARY is a busy month in the Granite Belt, and orchardists are fully occupied gathering, packing, and marketing the crop of midseason fruits, consisting of plums of several kinds, peaches, nectarines, pears, and apples. The majority of these fruits are better keepers and carriers than those that ripen earlier in the season; at the same time, the period of usefulness of any particular fruit is very limited, and it must be marketed and disposed of with as little delay as possible.

With the great increase in production, owing to the large area of new orchards coming into bearing and the increasing yields of those orchards that have not come into full profit, there is not likely to be any market for immature or inferior fruit. There will be ample good fruit to fully supply the markets that are available and accessible. Much of the fruit will not carry far beyond the metropolitan market, but firm-fleshed plums, clingstone peaches, and good firm apples should stand the journey to the Central District, and, if they are very carefully selected, handled in a manner to prevent any bruising, and properly graded and packed, they should carry as far as Townsville. Growers must remember that, given a market fully supplied with fruit, only such fruit as reaches that market in first-class condition is likely to bring a price that will pay them; consequently the grower who takes the trouble to send nothing but perfect fruit, to grade it for size and colour, to pack it carefully and honestly, placing only one-sized fruit, of even quality and even colour, in a case and packing it so that it will carry without bruising, and, when opened up for sale, will show to the best advantage, is pretty certain of making good. On the other hand, the careless grower who sends inferior, badly graded, or badly packed fruit is very likely to find when the returns for the sale of this fruit are to hand that after paying expenses there is little, if anything, left. The expense of marketing the fruit is practically the same in both cases.

Then why "spoil the ship for a ha'p'orth of tar" after you have gone to the expense of pruning, spraying, manuring, and cultivating your orchard? Why not try and get a maximum return for your labour by marketing your fruit properly? The packing of all kinds of fruit is a fairly simple matter, provided you will remember—

(1) That the fruit must be fully developed, but yet quite firm when gathered.

(2) That it must be handled like eggs, as a bruised fruit is a spoilt fruit, and, when packed with sound fruit, spoils them also.

(3) That only one-sized fruit, of an even degree of ripeness and colour, must be packed in a case.

(4) That the fruit must be so packed that it will not shift, for if it is loosely packed it will be so bruised when it reaches its destination that it will be of little value. At the same time, it must not be packed so tightly as to crush the fruit.

If these simple rules are borne in mind, growers will find that much of the blame they frequently attribute to the fruit merchants or middlemen is actually the result of their own lack of care. Fruit that opens up in the pink of condition sells itself, whereas any fruit that opens up indifferently is hard to sell on any except a bare market, and on a glutted market is either unsaleable or realises such a poor price that the grower is frequently out of pocket and would have been better off had he not attempted to market it.

If spraying with arsenate of lead, and systematic bandaging, has been properly carried out, there will be comparatively few codlin moths to destroy the later ripening pip fruits; but if these essential operations have been neglected or carelessly carried out a number of moths will hatch out and the eggs laid by them will turn to larvæ that will do much damage, in some cases even more than that caused by the first broods that attack the fruit as soon as it is formed. Where there is any likelihood, therefore, of a late crop of moths, spraying with arsenate of lead must be continued if the late crop of pip fruits is to be kept free from this serious pest.

Fruit fly must be systematically fought, and on no account must any fly-infected fruit be allowed to lie about on the ground and breed this pest, to do further damage to the later ripening fruits.

Citrus orchards will need to be kept well cultivated in the drier and warmer parts of the State, and, where necessary, the trees should be irrigated. If scale insects are present, the trees should be either sprayed, or, better still, treated with hydrocyanic acid gas.

Western grapes are in full season, and if they are to be sent long distances by rail then they are all the better to be cut some hours before they are packed, as this tends to wilt the stems and keep the berries from falling off in transit. The fruit must be perfectly dry when packed, and should be as cool as possible. It must be firmly packed, as a slack-packed case always carries badly and the fruit opens up in a more or less bruised condition.

CLIMATOLOGICAL TABLE—OCTOBER, 1933.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·91	84	73	86	12, 13, 25	68	1, 2	103	5
Herberton	..	78	57	85	25	46	22	186	5
Rockhampton	30·03	83	63	89	30	55	27	407	6
Brisbane	30·07	79	62	89	21	55	20	382	13
Darling Downs.									
Dalby	30·03	79	56	92	22, 30	49	19	573	9
Stanthorpe	..	73	50	85	30	40	6	318	8
Toowoomba	..	75	54	90	30	45	9	267	9
Mid-interior.									
Georgetown	29·91	95	60	100	6, 7, 8	54	28, 30, 31	50	4
Longreach	29·97	91	61	101	4, 31	47	27	158	3
Mitchell	30·01	82	54	95	31	41	15	263	5
Western.									
Burketown	29·91	94	69	98	12, 29	63	1, 27, 29	45	1
Boulia	29·95	93	61	105	24	52	27	Nil	..
Thargomindah	29·98	87	62	102	22, 31	53	27	43	2

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF OCTOBER, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING OCTOBER, 1933, AND 1932, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Oct.	No. of Years' Records.	Oct., 1933.	Oct., 1932.		Oct.	No. of Years' Records.	Oct., 1933.	Oct., 1932.
North Coast.	In.		In.	In.	*Central Highlands.*	In.		In.	In.
Atherton	0·89	32	1·86	0·46	Clermont	1·31	62	2·15	1·00
Cairns	2·12	51	2·40	0·49	Gindie	1·34	34	2·10	1·54
Cardwell	2·06	61	2·58	1·15	Springsure	1·62	64	2·69	2·71
Cooktown	1·05	57	1·03	0					
Herberton	0·97	47	1·86	1·10					
Ingham	1·92	41	2·84	0·52					
Innisfail	2·98	52	15·14	0·69					
Mossman Mill ..	3·05	20	2·09	0·77	*Darling Downs.*				
Townsville	1·39	62	1·20	0·10					
					Dalby	2·02	63	5·73	2·92
Central Coast.					Emu Vale	2·17	37	2·91	3·30
					Hermitage	1·90	27	1·77	2·83
Ayr	0·98	46	0·85	0	Jimbour	1·89	45	2·45	2·52
Bowen	1·03	62	2·02	0	Miles	1·96	48	5·67	2·20
Charters Towers ..	0·69	51	1·92	0·60	Stanthorpe	2·54	60	3·18	2·48
Mackay	1·67	62	1·45	0·21	Toowoomba ..	2·54	61	2·67	2·62
Proserpine	1·69	30	2·76	0·08	Warwick	2·30	68	2·62	3·63
St. Lawrence ..	1·73	62	4·66	1·53					
South Coast.									
					Maranoa.				
Biggenden	2·25	34	7·32	4·37					
Bundaberg	2·06	50	4·48	6·23					
Brisbane	2·55	82	3·82	2·98	Roma	1·72	59	3·35	1·11
Caboolture	2·48	46	4·36	3·01					
Childers	2·54	38	8·18	5·17					
Crohamhurst	3·23	40	5·99	2·45					
Esk	2·55	46	1·77	4·74					
Gayndah	2·36	62	4·87	3·58					
Gympie	2·67	63	5·33	3·09	*State Farms, &c.*				
Kilkivan	2·59	54	3·76	3·48					
Maryborough ..	2·66	61	8·28	5·90	Bungeworgorai ..	1·35	19	3·09	0·71
Nambour	2·92	37	6·33	3·34	Gatton College ..	2·00	34	1·56	2·60
Nanango	2·27	51	1·45	3·33	Kairi	1·00	19	1·82	0
Rockhampton ..	1·74	62	4·07	1·22	Mackay Sugar Experiment Station	1·39	36	1·29	0·28
Woodford	2·53	46	3·72	7·50					

GEORGE G. BOND, Divisional Meteorologist.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	December. 1933.		January. 1934.		Dec. 1933.	Jan. 1934.
	Rises.	Sets.	Rises.	Sets.	MOONRISE. Rises.	Rises.
					p.m.	p.m.
1	4·49	6 33	5·0	6·50	5·58	7·17
2	4·49	6·33	5·1	6·50	6·53	8·0
3	4·49	6·34	5·2	6·50	7·45	8·27
4	4·49	6·35	5·2	6·50	8·33	9·8
5	4·49	6·36	5·3	6·50	9·19	9·37
6	4·49	6·37	5·3	6·50	10·0	10·6
7	4·50	6·37	5·4	6·51	10·34	10·35
8	4·50	6·38	5·5	6·51	11·5	11·7
9	4·50	6·38	5·6	6·51	11·35	11·38
10	4·50	6·39	5·6	6·51	..	..
					a.m.	a.m.
11	4·50	6·39	5·7	6·51	12·5	12·17
12	4·51	6·40	5·8	6·51	12·35	1·4
13	4·51	6·40	5·9	6·51	1·8	2·0
14	4·51	6·41	5·10	6·51	1·45	3·2
15	4·52	6·41	5·11	6·51	2·26	4·12
16	4·52	6·42	5·12	6·52	3·21	5·26
17	4·52	6·42	5·13	6·52	4·23	6·39
18	4·53	6·43	5·13	6·52	5·32	7 48
19	4·53	6·44	5·14	6·52	6·43	8·52
20	4·53	6·44	5·15	6·52	7·54	9·54
21	4·54	6·45	5·15	6·52	9·3	10·53
22	4·54	6·45	5·16	6·52	10·8	11·53
					..	p.m.
23	4·55	6·46	5·16	6·52	11·8	12·41
					p.m.	
24	4·55	6·47	5·17	6·51	12·6	1·47
25	4·56	6·47	5·18	6·51	1·8	2·42
26	4·56	6·48	5·19	6·50	1·59	3·36
27	4·57	6·48	5·20	6·50	2·57	4·27
28	4·58	6·49	5 20	6·49	3·53	5·15
29	4·58	6·49	5·21	6·49	4·49	5·59
30	4·59	6·50	5·22	6·48	5·42	6·37
31	5·0	6·50	5·23	6·47	6·31	7·10

Phases of the Moon, Occultations, &c.

2 Dec.	○	Full Moon	11 30 a.m.
10 ,,	☽	Last Quarter	4 23 p.m.
17 ,,	●	New Moon	12 52 p.m.
24 ,,	☾	First Quarter	6 8 a.m.

Apogee, 4th December, at 11.18 p.m.

Perigee, 17th December, at 10.6 p.m.

Saturn rises at 11.31 a.m. and sets at 1.0 a.m. on the 1st; on the 15th it rises at 10.27 a.m. and sets at 11.55 p.m.

The Southern Cross will disappear in the early evening hours in November, even in Southern Queensland, where, however, its reappearance in the south-south-east will occur shortly before midnight near the end of the month to observers eastward of the 145th meridian.

Kappa Geminorum, magnitude 3.6, will be occulted before 3 a.m. on the 6th, when a little west of the meridian.

When Mercury rises at 1 hour 11 minutes before the Sun on the 6th it will be at its greatest western elongation, 21 degrees.

On the 13th Jupiter will be in conjunction with the Moon, about 5 a.m., when high up in the N.N.E. It will then be broad daylight, but about 2 hours earlier Jupiter may be seen about 6 degrees (the length of the Southern Cross) north of the crescent Moon. With Spica about the same distance to the east an interesting triangle will be formed.

On the 20th at 5 p.m. Venus will be very near the crescent Moon, the distance between them being little more than the diameter of the latter. An hour later a still closer conjunction between Saturn and the Moon will occur in the N.W.

Also in broad daylight at 7 p.m. on the 20th Saturn will be occulted at places north of Brisbane.

On the 21st Venus and Saturn in Capricornus will appear to be less than half a degree apart; a week later the distance between them will be slightly more than 4 degrees, as on the 15th.

The Solstice will occur on the 22nd, when the Sun, having reached its extreme southern limit (23 degrees 27 minutes), will appear to stand still before turning northward.

Venus will reach the highest point in luminosity for this year and the next on 31st December.

Mercury rises at 3.47 a.m. on the 1st and at 3.40 a.m. on the 15th.

Venus sets at 10.3 p.m. on the 1st and at 9.52 p.m. on the 15th.

Mars sets at 8.51 p.m. on the 1st and at 8.39 p.m. on the 15th.

1 Jan.	○	Full Moon	6 54 a.m.
9 ,,	☽	Last Quarter	7 36 a.m.
15 ,,	●	New Moon	11 37 p.m
22 ,,	☾	First Quarter	9 50 p.m.
31 ,,		Full Moon	2 31 a.m.

Perigee, 15th January, at 11.12 a.m.

Apogee, 28th January, at 5 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.